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ABSTRACT

This environmental education program consists of two levels: primary and intermediate. The material in this publication encompasses the primary level. The learning materials are activity-based and incorporate process and subject area skills with knowledge and concern for the environment. The program is also interdisciplinary including activities and skills from art, language arts, mathematics, music, science, and social studies. The activities in this primary set center on sensory awareness, basic ecological concepts, and developing positive attitudes toward the environment. The materials consist of student activity cards, student information cards, and the teacher's guide. Each activity card introduces the environmental concept and lists activities and an informal evaluation. The cards are non-graded and non-sequential. The teacher's guide contains overall teaching suggestions and suggestions by card. It also includes references for each card and four indexes on subject, subject area and process skills, information cards, and outdoor activities. (Author/MR)

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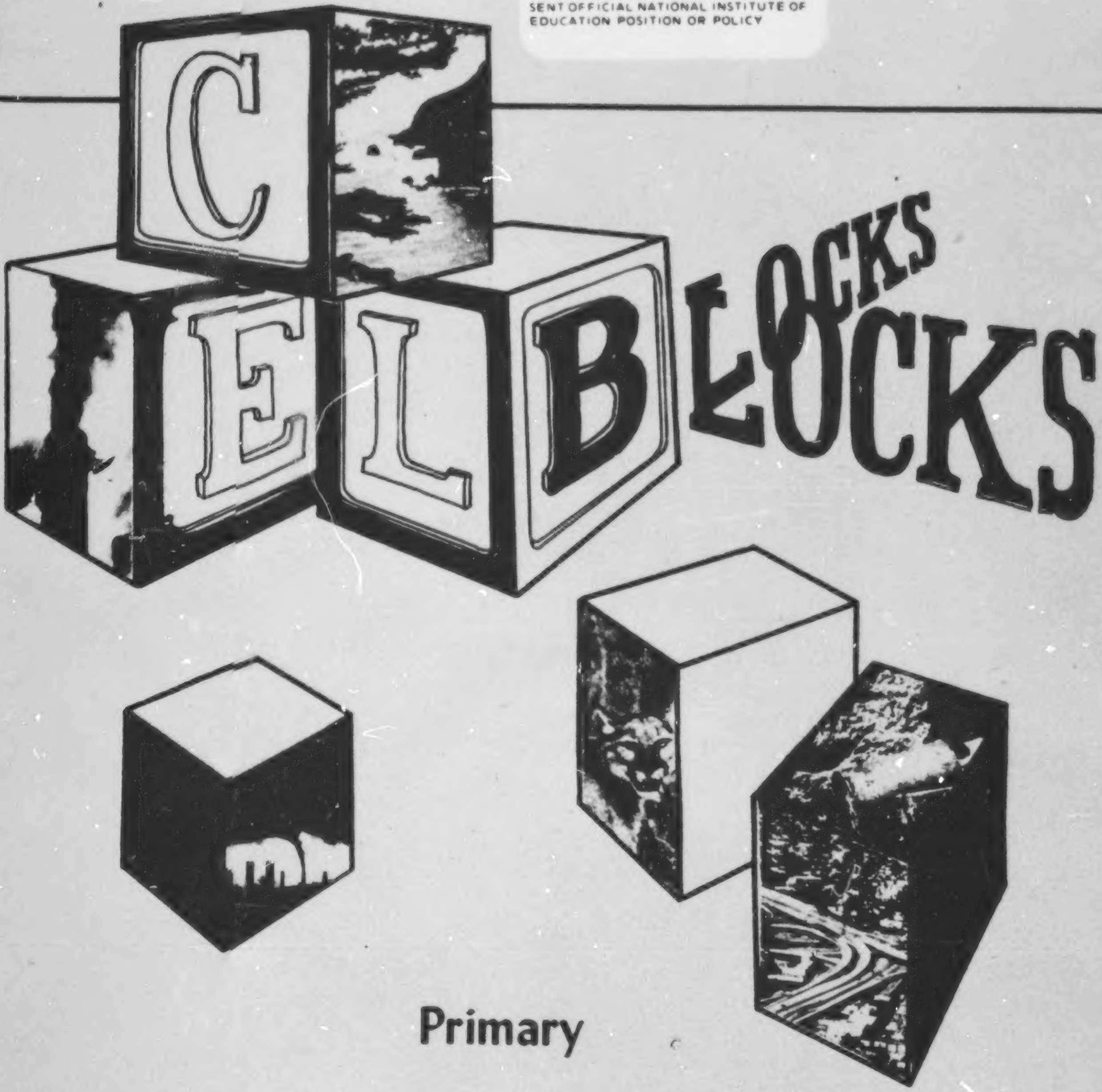

Primary

Interdisciplinary Environmental Learning Packets

SE 020 012

PRIMARY CEL BLOCKS

Teacher's Guide

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ELEMENTARY ENVIRONMENTAL LEARNING PACKET

K - 3

SECOND REVISED EDITION

Developed by the Elementary Environteam
as a portion of the
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"BROAD SPECTRUM ENVIRONMENTAL EDUCATION PROGRAM"

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Teacher's Guide - Primary CEL Blocks

Table of Contents

page

1. Introduction to Materials 1

2. Teaching Suggestions

Field Trip Suggestions 4
Individual Student Cards 7

3. References by Student Card 96

4. Indexes

Subject 107
Subject Area Skills 119
Information Cards 126

INTRODUCTION

How are these materials different?

These materials were developed and tested by classroom teachers working under the guidance of the project staff. The learning materials were found to be an effective tool for teaching environmental education.

CEL Blocks is interdisciplinary. The cards include activities and skills from the areas of art, language arts, math, music, science, and social studies.

CEL Blocks is an activity-based program, a "hands-on" approach to environmental education. These materials incorporate process and subject area skills with knowledge and concern for the environment. The program offers the student opportunities to explore and learn about the environment and to develop a set of values toward the environment.

CEL Blocks consists of two nongraded sets of activity cards, primary and intermediate. Each set offers opportunities for learning at varied levels and on varied topics. The primary cards focus on sensory awareness, basic ecological concepts, and developing positive attitudes toward the environment. The intermediate cards offer these same opportunities but add the dimension of investigating and structuring solutions to environmental problems.

How are the materials organized?

The materials in the primary set consist of the colored student activity cards, the white student information cards, and the teacher's guide. The student activity cards center around and are color coded according to three conceptual themes. The themes and the color coding are given below.

1. similarities and differences--blue and green
2. interaction and interdependence--pink and red
3. change and adaptation--yellow and gold

Each student activity card is a complete unit, with a built-in objective, activities, and evaluation. Each card presents a wide range of learning activities: investigations, experiments, discussions, simulations, readings, puzzles, or art activities. Each card and its activities is explained in the Teaching Suggestions section of the Teacher's Guide. The cards are non-graded and non-sequential. They can be used in any combination. The format of the primary student card is shown below. The Do More section gives the student a choice of optional activities. The What Now section contains an informal evaluation of the attainment of the student objective.

Primary format

To do . .

. . . initiating activity

. . . arouses interest

. . . introduces the student to the concept

Do more . do more . .

. . . asks questions

. . . more activities on the same concept

. . . gives the student a choice of activities

. . . gives the student more insight into the topic

What now?

Evaluation

measures the attainment of the student objective

2

Student information cards are printed on white card stock. They are designed to be used in conjunction with the activity card they accompany. In some cases you may want to use the card as a master and duplicate it for the students.

The Teacher's Guide contains four sections: introduction, teaching suggestions, references, and indexes. The teaching suggestion section contains overall teaching suggestions and suggestions by card. The reference section lists supplemental materials which can be used to enrich each card. The index section contains three indexes: index by subject, subject area and process skill, and index of information cards. This section also contains a copy of the student glossary.

How should these materials be used?

The developers of these materials were elementary teachers. They recognized the need for flexible materials that could be used in a variety of instructional situations. You should be able to fit these cards into the instructional strategies you normally employ. They can be used by large groups, small groups, or independent students. The cards can be used to supplement texts, as the basis for a unit on the environment, or as part of an independent learning center.

Since the cards are nongraded and non-sequential, you can choose the cards you think are most appropriate for your students. Since the cards have been indexed according to subject and subject area or process skills, you should be able to select cards that complement the subjects and skills that are stressed in other materials.

The Teacher's Guide contains a section of teaching suggestions. In addition to general suggestions, this section contains ideas for implementing each card in your classroom. Again, many of these suggestions were contributed by classroom teachers who had taught the cards.

TEACHING SUGGESTIONS

FIELD TRIP SUGGESTIONS

The primary cards call for very few field trips off the school grounds. There are, however, a large number of activities in the cards that call for outside exploration on the school grounds or nearby. In order for these activities to succeed, advance planning must be done by the teacher. Two checklists are included here: one is for on-campus activities, the other for field trips off the school grounds.

ON-CAMPUS CHECKLIST

1. Survey the area ahead of time. Be certain the students can make the needed observations in that area. If no suitable area can be found, try substituting another activity. Note any hazards you observe.

2. Secure any help necessary. If you plan to use other adults or older students, be certain they understand their responsibility as well as the group task.

3. Assemble necessary materials. The materials needed should be listed in the teacher's guide.

4. Prepare the class for their tasks. Discuss with the students ahead of time their responsibilities for observation, data collection, and conduct. If necessary, establish behavioral rules and standards of dress. With younger students, it is often necessary to simulate the activity in the classroom before going outdoors. Caution the students about hazards noted.

Hint: Start with short experiences and build from there. Be sure the students have enough to keep them busy. Some teachers find it helpful to give the students a clipboard with a data sheet as a reminder of their task.

The following list was developed to be used for field trips that require an absence from the school grounds. This checklist elaborates some of the suggestions given earlier.

CHECKLIST FOR FIELD TRIPS

I. Preparation

A. Secure a map of the area if applicable.

B. Make the trip yourself prior to taking the children. Complete a sketch of what routes you will use if necessary. Make sure you can accomplish what you set out to do.

C. Take advantage of guide service whenever the facility has it. Contact the guide well in advance if there are specific subjects you wish him to cover, so he will have ample time to prepare.

D. Make use of a resource person if you do not feel qualified in an area. Often he will meet with you if he is unable to accompany the class.

E. Make transportation arrangements through the office.

F. Secure a signed permission slip from every child for your protection.

G. Prepare a small first-aid kit. Include insect repellent.

H. Provide the children with a sketch of the proposed route. It promotes "ordered" confusion and later becomes an important addition to their data booklets on field activities.

I. Check restroom facilities or plan ahead.

J. Check food or drink facilities, if applicable.

II. Suggested Equipment

A. Collecting
  1. Plastic bags
  2. Small jars with lids
  3. Large strainer, or collander.

B. Observing
  1. Hand Lenses
  2. Binoculars
  3. Picture-key books.

C. Recording
  1. Pencils
  2. Field notebooks for records, sketches, maps, notes
  3. Camera, if so desired.

III. Suggested Clothing (Plan for changing times)

A. Long pants (protection from insects, thorns, etc.)

B. Long sleeved shirt or blouse (above reasons)

C. Tennis shoes or old shoes (no sandals)

D. Canteens for water where needed.

IV. Behavioral Rules

A. Walk by two's.

B. Stay with the group.

C. Form semi-circles around teachers or guides when something is being pointed out.

D. Be polite. Listen.

E. Respect property. Don't litter or destroy.

F. Walk quietly and listen well. You will see and hear more.

G. The teacher or guide will tell you what can be taken for collections.

V. Follow-up Activities

A. Reconstruct the area you visited.

B. Talk about the variety of living things that comprises your community.

C. Compare the school area to the visitation site.

D. Write or dramatize a story about some things you saw.

E. Encourage discussion about why we should preserve natural areas and be concerned about pollution.

F. Invite more resource people to visit.

G. Talk about hunting, fishing, and game laws.

H. Discuss possible changes that could be expected as the seasons pass.

Student Card #1

General Objective: The student will understand the meaning of the word "environment."

Student Objective: Given a set of drawings, the student will be able to correctly identify those objects found in his immediate environment.

Conceptual Theme: Similarities and Differences

Materials:
- magazine pictures
- scissors
- glue
- newsprint or construction paper
- writing paper or recorder
- pencil
- Evaluation ditto, "Things in Your Neighborhood" (1-1) (one per child)

Teaching Suggestions: Many students have heard the word "environment" but have misconceptions about its meaning. Environment includes all the things which make up the students' surroundings. This includes the physical setting, the social setting, and the interaction of the two. It will probably be simplest to tell the students that everything they see, feel, smell, and hear is part of their environment.

Prepare the students for their walk by asking them to observe their classroom first. Encourage them to use all their senses. Record on the board the things they observed by sense. When you are sure they understand the task, take them for a walk around the school. If this is your first outside activity with the class, keep it short. Lengthen observation time with successive experiences. You may wish to carry a tape recorder to record their discoveries. When you return to the classroom, construct an experience chart for the observations made during the walk. An example is given below:

We saw	We heard	We felt	We smelled	We tasted
birds	birds	sun	bread baking	air (no taste)
jet trail	dog barking	breeze	clean air	

Since the idea behind this card is environmental awareness, you may wish to teach the students this song about their senses. Use the tune of "Mary Had a Little Lamb."

> We all live environment, environment, environment
> We all live environment, and we are here to say--
> (continue, substituting see, smell, feel, taste, hear for live.)

Let students choose at least one activity from the Do More section. You may have each child make a collage, or this may be done as a bulletin board display by the entire class. If the students are too young to write their own story, you might have them record one instead.

As an evaluation, let students circle the things they might see in their neighborhood. Use the black and white master provided to make a spirit master. Discuss their answers.

Student Card #2

General Objective: The student will be aware of living and nonliving things in the environment.

Student Objective: Given a set of pictures, the student will be able to correctly classify objects as to living and nonliving.

Conceptual Theme: Similarities and Differences

Materials: six-part flat for plants (or six containers), one per group
soil for planting
seeds (two or three kinds)
magazine pictures
glue
scissors
crayons or colored chalk
newsprint

Teaching Suggestions: Once again, you may prepare the students for the introductory activity by simulating it in the classroom. The students may have difficulty locating a large number of living things in the classroom. This is a good time to remind them that they too are living things.

You may sit quietly in a circle and observe living things, or you may have the students actively explore a small area for living things. It is not necessary for them to collect any things, merely identify them.

Flats for planting may be obtained from a garden supply store, or you can substitute six separate containers. If supplies are adequate, it is generally better to let the children plan their experiment in small groups. They may use nonliving things from the room, i.e., crayons, pencil, paper, or from outside. Bean and corn seeds are fast growers. Plant additional ones for safety. Caution the children not to overwater their seeds. Keep a chart of the daily observations on each container. Ask the students to draw their own conclusions. Be prepared for seeds that don't sprout.

The students may find that change is a property of nonliving things, as well as living ones. One of the optional activities asks them to plan an experiment to see if nonliving things change. (The ESS unit, Changes, has some excellent experiments to illustrate this point. See references for further information.) You can probably see many examples of weathering in your own environment. Have students look at sidewalks, roads, and rocks around the school grounds.

For the evaluation, you can prepare a flannel board or a large piece of construction paper or you may have each student construct his own collage. Have the students classify the pictures as to living or nonliving. Try to include pictures of people, pets, houses, trees, cars, highways, grass, and other things seen daily.

Student Card #3

General Objective: The student will be aware of diversity in living things.

Student Objective: The student will be able to list at least 4 ways people are different.

Conceptual Theme: Similarities and Differences

Materials:
clear plastic wrap
construction paper
white, clear-drying glue
kraft paper, large sheet for each child
crayons or markers
data card, "Things That Make Me Special"(3-1), one for each child
hand lens (optional)

Teaching Suggestions: This card introduces the concept of diversity in living things. This idea is pursued in latter cards.

Begin by focusing attention on the children. The first activity involves making mobiles of the children's heads. The directions are given below:

1. Using construction paper, have children cut out the essential parts of their heads, i.e., hair, ears, nose, mouth, eye lashes, eyebrows. The outer edge of the hair should be the width of the clear plastic wrap.

2. Give each child a piece of plastic about the size of their head. The plastic must be as long as the hair.

3. Have the child lay the parts in position on the piece of plastic wrap. Use clear-drying glue to glue the parts in place.

4. Put another piece of plastic wrap over the top of the completed face.

5. Using two strips of white paper, make an upper and lower frame for the head. (In other words, staple a piece of folded paper on the top and bottom of the head.)

6. Punch a hole through the top frame and hang from the ceiling with a string.

Once the children have finished and hung the mobiles, take a few minutes to look at them. Note the differences in appearance of the children. Discuss the differences you see.

Continue by making life-sized models of the children. Divide the students into pairs. You will need one piece of kraft paper the size of each child. Have one child lie on the paper while the other traces his outline. Markers or crayons work best. Reverse the procedure. After all the children have finished their outlines, have them add their own features. You might like to use colored yarn for hair. The presence of a large mirror in the room would be helpful for this activity. Let each child hang his finished product and compare the differences found.

To further reinforce the concept of diversity, explore the activities in the Do More section. The data card, "Things That Make Me Special," may need some teacher explanation. For the younger children, you may want to do it as a group, discussing each item as you go. For the older children you may want to add some quantitative measures: actual measurement of height, graphing of eye color, etc. Attach each child's finished data card to the model. You may wish to make a summary chart for the entire class.

This could be a good time for a lesson in human relations. Talk about being different, and our feelings toward people who are different from us.

Generalization of the concept can be accomplished in many ways. A simple way is by observation of the plants and animals in your area. You might also locate a filmstrip on diversity.

The advantage of being different is explored in the story, "The Making of a Horse" (37-1). This might be a good time to read it to the class. Discuss how being different helped the new horse survive while the old ones died out.

Finally, make a list of all the ways people are different. For younger students, you may need to act as a recorder. The students can use the list on the data card as a starter. They will probably be able to think of many additional ways people are different.

Student Card #4

General Objective: The student will explore the concept of change as it relates to him and his environment.

Student Objective: Given a list of characteristics, the student will correctly classify those that change and those that do not.

Conceptual Theme: Change and Adaptation

Materials: student pictures from home
stamp pad
newsprint or construction paper
magnifying glasses
crayons or markers
evaluation card, one for each student (optional)

Teaching Suggestions: This card can probably best be accomplished as a group activity. Start by asking students to bring in pictures of themselves when they were younger. Baby pictures are best, but all students may not have them. Use them to make a bulletin board. You can make this a game by not identifying the pictures. Have a contest to guess the identity of the pictures.

As a class, discuss the ways people have changed since the pictures were taken. Make a list for the class. Several excellent visual aids are listed in the resources.

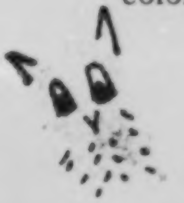
Thumbprint pictures are easy to make. Have the students press their thumbs first on the stamp pad and then on the paper. You can make "bugs" from the prints by adding legs and antennae. Color in a background. Use the magnifying glasses to examine the thumbprints. Students may want to compare their own thumbprints with their classmates.

The thumbprint activity can serve as an introduction to a discussion of things that have not changed. Again you may wish to make a list. The mobiles and outlines from the previous card may be a good reference here.

Weather is probably the most obvious change in the environment that affects us. Seasonal changes are also fairly obvious. Other agents of natural change include fire, earthquakes, hurricanes, tornadoes, disease. The list of man-made changes in the environment that affect us is almost endless. Examples include air pollution, filling in marshes to build houses, building roads.

Allow students time outside to identify something that is changing. They may want to explain their choice to the rest of the class.

As an evaluation, you may have the students complete the ditto provided, or you may merely classify the changes as a group. Remember hair color changes with age and exposure to the environment.



General Objective: The student will be aware of the use of shapes in his environment.

Student Objective: The student will be able to correctly identify a triangle, rectangle, and circle as found in the environment.

Conceptual Theme: Similarities and Differences

Materials: large geometric shapes (triangle, rectangle, circle) to be used as patterns (building blocks will do)
construction paper
magazines
paste or glue
scissors
string
wire or sticks
colored tissue paper or cellophane

Teaching Suggestions: In order for this activity to succeed, the children must be able to recognize a triangle, rectangle, and square. The aim of the activity is simply to make the student aware of the use of shapes as part of his environment. This card provides a good follow-up to introductory activities on shape recognition.

You will need an adequate supply of building blocks or patterns on hand. The children should begin by tracing the objects and creating their own inventions. They may want to work with the shapes for a while before they finalize their invention. When they are sure what they want to do, then glue the shapes in place.

Let the students choose one or two suggestions from the Do More section rather than having them do all of the suggestions. The younger the children, the more reinforcing activities they may need.

The evaluation may take the form of an observational walk around the school. Have students look for usage of the shapes in the man-made structures and in nature. They can record their observations by making a class photograph album or by making drawings. An optional evaluation activity would be to provide the students with pictures of objects in the environment. Have them classify the pictures according to the shapes they contain.

Student Card #6

General Objective: The student will familarize himself with textures found in the environment.

Student Ojbective: Given a list of words, the student will correctly identify those which describe textures.

Conceptual Theme: Similarities and Differences

Materials: touch bags, one for every four students
newsprint
pencil, crayons
construction paper
glue
paper bags, one for each student

Teaching Suggestions: Before class, prepare touch bags. You should try to include a variety of objects having different textures. Be sure to include natural and man-made objects. Include objects of metal, cloth, and wood.

Originate the activity by organizing the students in groups. Give each group a touch bag. Let each student take turns feeling and describing the things in the bag. Either record the words the students use to describe the objects or list them on the board. Have groups swap bags and repeat the procedure.

Ask each student to make up a touch bag for the rest of the class. Caution them not to include objects which might harm someone else. Allow time for exploring the bags.

This would be a good time for the Paul Showers' book, Find Out by Touching (see resources). Read it to the class, or have the students read it. There are also several films listed on texture.

For the Do More section, group students in pairs. Blindfold one student. Remind the students that they are responsible for the safety of their blindfolded partner. Have the other student lead the blindfolded student in touching common objects such as desks, walls, books, carpet, etc. Let the students reverse roles and repeat the procedure.

Let the students choose from the remainder of the activities in the Do More section those they would like to do.

For an evaluation, furnish the students with a list of words. Ask them to choose the ones that describe the way objects feel. You may use this list or one of your own:

soft
wet
smooth
rough
loud
dark
cold
sandy
rotten
slippery
sharp
sweet

Student Card #7

General Objective: The student will explore odors in his environment.

Student Objective: Given an unknown object, the student will be able to describe it using only "smell words."

Conceptual Theme: Interaction and Interdependence

Materials:		
	paper	scissors
	crayons	blindfolds
	pencil	smell bags (see suggestions)
	magazine pictures	

Teaching Suggestions: Before class, prepare a large bulletin board shaped like a nose. This will be for the students' pictures and smell words.

A good way to prepare the students for their observations is by reading the Paul Showers' book, Follow Your Nose, or some of the new smell books (see resources). Talk about the importance of our sense of smell.

Take the students on a walk inside the school and out. Have them smell things along the way. You might plan to pass the kitchen and garbage areas. You can also smell the air, flowers, grass, etc. Have the students draw a picture of at least one thing they smelled. Let the students talk about each picture as they put it on the board. Keep a list of the "smell words" they use. Add them to the board.

Have students bring pictures from home or furnish them with pictures of things that smell. Ask them to decide whether they like the smell or not. Classify the pictures according to like or dislike. Talk about why they like certain smells but not others.

Have students bring from home objects for the smell game. Divide students into small groups.

Humans do not rely as heavily on their sense of smell as do many animals. Smell is one way animals communicate. The point is explored further on the card, A Different Language (14-1). Some animals also use smell as a weapon. The skunk, of course, is the classic example.

For the evaluation, prepare smell bags for the class. Put only one thing in each bag. Include things such as cotton soaked in perfume; vinegar; shaving lotion; fresh fruit (cut); onion or garlic; tree bark; grass.

General Objective: The student will be aware of different sounds in his environment.

Student Objective: Based upon observations, the student will be able to identify and describe at least one sound from the environment.

Conceptual Theme: Interaction and Interdependence

Materials:

- newsprint
- crayons or markers
- tape recorder
- paper and pencil
- record player
- sound record (see resources)
- magazines
- glue
- scissors
- construction paper

Teaching Suggestions: The general aim of this activity is to start students thinking about sounds in the environment and their reactions to them. Prepare the students for their walk by reading the Paul Showers' book, The Listening Walk.

On your sound hike, plan a time to sit quietly and listen. The hike should be a fairly short one. During the hike, the students should not talk, only listen. Have them listen for natural (dogs barking, birds, etc.) and man-made sounds (cars, machines, etc.). They may want to do their pictures outside, or you can wait until you return to the room. After they have finished their pictures of the sound producers, have them duscuss the sounds they heard. Collect the information to complete the following chart. Older students could be given a copy of this chart before going on the hike.

What made the sound?	Where did you hear it?	Was it loud or soft?	Did you like it?

For the first four items in the Do More section, play a sound record (see resources). Try to identify sounds that help people, sounds that are nice to hear, sounds that bother you, natural and man-made sounds.

The DLM record listed in the resources can also be used for an evaluation. The student can identify and describe the sounds on the record. You can do the same thing with a tape recording of your own making.

For the tape recordings, students can work singly or in groups. They can "stage" sound effects or wait for sounds to happen.

Student Card #9

General Objective: The student will observe the interaction of noise and people in the environment.

Student Objective: Based on information collected, the student will list at least one way to reduce noise in the environment.

Conceptual Theme: Interaction and Interdependence

Materials:
tape recorder
paper and crayons
pencil

Teaching Suggestions: The student may need some help in listing the ways that noise affects people. Almost all industrial jobs have a high noise level. If this is done by the entire class, this might be a good time for a practical experiment: Give the students an assignment, but constantly interrupt them with loud noises. A blender producers a very annoying sound.

Noise is measured in decibels. The threshold of hearing is 0 decibels. The chart below lists some sounds, their responses and decibel levels.

Example of Sound	Decibel Range	Human Response
Breathing	10	Audibility
Whisper	30	Quiet
Average residence	40	Comfort
Normal conversation	60	
Rush-hour traffic	80	Annoying
Subway	100	Prolonged exposure causes damage to hearing
Jet airport	120	Discomfort
Discotheque	130	
Shotgun blast	140	Pain
Jet plane	150	

Source:

1971 EQ Index, National Wildlife, November, 1971.

This card could easily tie into a field trip to the airport. You might also consider inviting a safety engineer to talk to your class about noise. At the present time, very few places have established safety standards in regard to noise.

Another person who tries to minimize noise is an interior decorator. Perhaps you can have one talk to the class about ways to cut down noise.

Student Card #10

General Objective: The student will express his feelings about happenings in the environment.

Student Objective: Given a sentence to complete, the student will be able to list at least one thing that makes him happy.

Conceptual Theme: Interaction and Interdependence

Materials:
scissors
crayons
chalk
drawing paper
pictures (see below)
bulletin board
construction paper } optional
glue }

Teaching Suggestions: Before class, prepare a large area to receive the students' pictures. You may want to divide the area using happy and sad faces, or some other designation.

A good introduction to this activity is the reading of the Charles Shultz book, Happiness is a Warm Puppy. If you have another suitable book or filmstrip, you can substitute it for this book. Tell the students this is one person's idea about what makes people happy.

After you have read the book and discussed happy and sad feelings, ask the students to find a picture of something that makes them happy. Ask them to find another picutre of something that makes them sad. Allow each student to express his feelings about his pictures and then attach them to the board. You may wish to record the students' comments. You can vary the activity by furnishing them with a picture and asking them to decide if the picture makes them happy or sad. This also allows you to choose pictures you would like to see discussed.

After this activity, use the student pictures to make a giant collage for the entire class.

All of the questions in the Do More section can be completed in a number of ways. The students can respond verbally, pictorially, or in writing. These items are intended to extend their thinking beyond themselves, by asking them to think about other situations.

The What Now? section can also be completed in the same ways listed above.

General Objective: The student to be aware of beauty in the environment.

Student Objective: Based upon observation, the student will describe to another person at least one beautiful thing he has noticed.

Conceptual Theme: Similarities and Differences

Materials: see Teacher Information Cards for material lists
record or tape of Inchworm

Teaching Suggestions: The real point of this card is an appreciation of the beauty in one's surroundings. This card gives the students several ways to express their awareness of the beauty found in the environment. This card can be used in conjunction with the following one on cinquains. In fact, the students could use the marigold sponge paper for writing cinquains. They could also do a cinquain on weeds.

Before class, obtain a record or tape of Inchworm or have the music teacher teach it to the class. After the class has listened to the song, talk about the meaning of the words. Try an awareness walk of your own. Ask the class to look for beautiful things around the school that they pass by everyday. This would also be a good time to collect weeds for the weed prints.

Marigolds are a natural pesticide. Apparently, the odor or taste of the marigolds is offensive to the pests. Many organic gardeners plant marigolds, onions, and garlic with their other plants to drive away pests. The idea of natural controls is explored on card 51. Organic gardening is discussed in the Ranger Rick article (see references).

Directions for the marigold sponge painting and weed prints are given following the teaching suggestions.

For the evaluation, you could have the older students write a note on the marigold sponge paper. Younger students can do their evaluation verbally or record it for a friend.

Student Card #11

Teacher Information Card

Marigold Sponge Painting

Materials:

onionskin paper (see note on size)
plastic ferns, bought at dimestore
sponges, to be cut up
tempra - green, yellow, orange, white
old aluminum pie plates (3 to 6)
small paint brushes

Directions:

1. Begin by mixing green, white with just a touch of yellow tempra in a pie pan. Color produced should be a very light green. Using small oblong sponges, the children should sponge paint a background on the onionskin. (Sponges should be almost dry.) Let dry.

2. Prepare a pie pan with dark green tempra. Have children dip the fern in the paint and then print it on the onionskin. (This green should be darker than the background.) Let dry a few minutes.

3. In a pie pan, put some yellow tempra. Right next to it, put some red tempra so the paint slightly mixes where they come together.

4. Using small (1" x 1") pieces of sponge, dip sponge in paint where the colors mix. Print on onionskin by slightly turning the sponge as you put it down, or by picking up and down on the sponge. This gives the marigold effect.

5. Using the darker green paint and a small brush or narrow sponge, make stems to attach the flower to the plant.

6. Mat the onionskin on orange construction paper for a lovely effect.

Note: These may be done on any size paper including note paper or letter head. Then the prints can be used for stationary.

Student Card #11

Teacher Information Card

Weed Prints

Materials:

water color paper, one sheet per child
onionskin or tissue paper, one sheet per child
white glue
small weeds, gathered by children
water colors
construction paper, slightly larger than water color paper
easel brushes

Directions:

This project works best when done in three time segments. Each step is given below:

1. Using the water color paper, make a wash with water colors. Lighter colors toward the middle, darker colors around the edges produce a beautiful finished product. Put these papers aside to dry and use again in Step 3.

2. Take the children outside to collect small weeds. The weeds should be a bit smaller in height than your paper. Each picture needs 2-4 weeds. Press these weeds between magazines or books at least overnight.

3. Now you are ready to assemble the paintings. Before you start, water the glue down to about one-half strength.

   a. Lay pressed weeds on water color paper.

   b. Using an easel brush (3/4"), lightly brush the entire surface of the water color, including weeds. When you get to the weeds, dap up and down, rather than brushing across.

   c. Lay a sheet of tissue paper or onionskin over this. Press down lightly. Do not allow the weeds to tear the tissue paper.

   d. Using brush and glue, lightly paint glue over the entire surface.

   e. Let dry. It may be necessary to trim edges if tissue hangs over. Mat on construction paper for a beautiful finished product.

General Objective: The student will express his thoughts about nature.

Student Objective: Utilizing the pattern provided, the student will write at least one cinquain on a subject of his choosing.

Conceptual Theme: Similarities and Differences

Materials: paper and pencil

Teaching Suggestions: The object of this card is merely to introduce the cinquain pattern to the students. Hopefully, the teacher and the students will find many opportunities to utilize this method of expression. This card is a natural combined with the preceding one.

Write the pattern on the board and help the students get started. The pattern is as follows:

Cinquain:

Line 1 - 1 word - subject or title.
Line 2 - 2 word - explains the title.
Line 3 - 3 word - shows action.
Line 4 - 4 word - completes line 3.
Line 5 - one word that also explains the title.

Encourage the students to start their own booklet of poetry and pictures. Although this card is only about cinquains, the students may want to try their hand at other forms of poetry or art. If you do this card early, you can start a collection that you add to as new topics are explored.

General Objective: The student will understand the meaning of the words interaction and interdependence.

Student Objective: The student will be able to show, by means of a drawing, at least 5 people he interacts with.

Conceptual Theme: Interaction and Interdependence

Materials: 5, 2' pieces of string per student
stamp pad and paper for thumbprints
soap and water for wash-up

Teaching Suggestions: Interaction and interdependence are very important words in environmental education, yet most primary students do not understand the meaning of these words. This card is an attempt to introduce these concepts to the students. See the index for additional cards that reinforce this concept.

If this is done as a group activity, give each child five pieces of string. Have him give the pieces of string to the people he talks to most. Emphasize that this is interaction; he interacts with these people when he talks to them. Ask the students to think about other ways they can interact. Make a list on the board. Ask the students to think of other things they interact with. Make a class list or a collage of these things.

Use the stamp pad for the concept of interdependence. Interdependence has been defined on the student card as needing each other. The child may have trouble thinking of people who need him. Have him think of his responsibilities and duties. People depend upon him to do certain things and behave in a certain manner. This list could include the teacher, parents, friends, pets, etc.

To enlarge the concept, have the children look for examples of interaction and interdependence in their immediate environment.

The object of the evaluation is to see if the students understand the difference by drawing people or things he interacts with.

Student Card #14

General Objective: The student will be aware of interaction in the environment.

Student Objective: Using materials provided, the student will construct a collage illustrating at least 5 ways he interacts with his environment.

Materials:
- jars with lids (or ant houses)
- bread crumbs
- magazines, glue, scissors
- construction paper
- story, "A Different Language" (14-1)
- information card, Studying Interaction in an Anthill (14-3)

Teaching Suggestions: Before beginning this card, be certain the students understand the meaning of the word interaction. Introductory activities are given on card 13.

Allow the students observation time for the To Do. Have them make a list of the things they see interacting. When you get back to the room discuss their lists. What things did they actually see interacting? How did they infer the others were interacting? What evidence did they see? Finally, discuss why interaction is important.

Have the students make an ants' nest. A large quart jar will make a good nest. Directions for collecting ants are given on the accompanying information card. Directions are also given there for students who would like to make their own ant house. There are also commerically produced ant farms. If you use the quart jars, cover the jar with a screen and put the jar in a shallow pan of water. This will prevent escapes.

Ants are suggested because they are so plentiful. You may want to supplement this observation with additional ones of other animals in the area. The students could contrast the ways different animals interact.

The story, "A Different Language," tells about the ways some animals communicate. Communication is a special form of interaction.

Have the students list all the things they interact with for one hour. You may need to remind them of some activities such as breathing, listening, seeing, etc. The list should be fairly long, even for one hour. For younger students you may want to shorten the time.

Have materials available for student collages. Let the students explain their collages to their group.

General Objective: The student will be aware of ways his home interacts with the environment.

Student Objective: Using a form of his choosing, the student will be able to show at least 3 ways his home interacts with the environment.

Conceptual Theme: Interaction and Interdependence

Materials: pattern for house parts (15-1) (see note below)
scissors, glue, magazines
construction paper
crayons
styrofoam and other disposable materials (optional)
transparency of card cover (optional)

Teaching Suggestions: Man is constantly interacting with his environment. Everything that man does affects his environment, just as his environment is constantly affecting him. This activity chooses the home as a focal point because the interactions that take place there are fairly obvious. The teacher can easily enlarge the discussion to the school or other areas.

Orginate the activity by having the students construct a house from construction paper. You may use the black and white master provided to make patterns, or you can have the students construct their own houses. The back of the house is left open so students can put what they like in it. Have each student color his house.

Students that live in trailers or apartment buildings can construct models of their homes by using boxes.

Have students create an environment around the house by adding trees, shrubs, sidewalks, etc. If you have the space, you can use the students' houses to create a community. You might wish to add schools, churches, stores, highways, apartment buildings, etc. Consider using used styrofoam and other disposable materials for construction.

First consider how the environment affects the home. Students will probably be able to see how wind and weather affect the house. Less obvious may be the ways plants and animals from the environment affect the home. Start with termites, spiders, roaches, grass, algae.

Have the students make collages of the ways the home and the things in it affect the environment. A transparency of the cover for this card may provide some ideas for discussion. What good things do you see in the picture? What things do you see that may hurt the environment? What ways can we reduce the number of harmful things?

This activity can be spaced out over a long period of time. It can be tied into other cards on interaction, trees, spiders, roaches, changes, composting, and pesticides (see index). The Ranger Rick article listed in resources is excellent.

For an evaluation, you can have the students list, or make a class list, of the ways the house interacts with the environment. The collages could also be delayed until this point.

General Objective: The student will be aware of living and nonliving things in a small environment.

Student Objective: Based upon observation, the student will collect data on a closed system and classify the things found as living or nonliving.

Conceptual Theme: Similarities and Differences

Materials: hula-hoop (or coat-hanger), one for each group
data card (or tape recorder), one for each group
pencil
hand lenses (optional)
newsprint
markers or crayons

Teaching Suggestions: The object of this activity is to have students concentrate their observations on a very small area. This can be accomplished in a number of ways. The method suggested here is tossing a ring of some sort into an area and then having the students collect data only in that area. Even in the limited environment of the school yard, the students should be able to see that variation in environmental conditions causes a variation in the type of life found in an area.

You may want to prepare the students for this activity by reviewing living and nonliving things (see card #2). You can play a game: have one student name something; let the class guess if it is living or nonliving.

If you cannot find hula hoops, coat hangers bent in a circle will do. Bend the hook into the circle also to prevent injuries. Divide the students into teams and assign each group an area to investigate. The students should close their eyes and toss the hoop. Once it has landed, the students should list everything they observe in that circle. You may wish to have them do a list or use the data form provided. If the students are young, you may wish to have the students talk about what they see, while you act as a recorder. Each group should complete observations in two different areas.

Have each group post their lists. Talk about what they found and the differences in the areas they were investigating. Try to reach some conclusions as to why some plants and animals were found in certain areas, but not in others. Factors that may account for these differences should include amount of sunlight, rain, wind, type of soil, presence of people, buildings, etc.

If the students need help with the concept of interaction, review the cards on interaction (see index).

The drawings can be done by each group as another way to contrast the environments they viewed.

Student Card #17

General Objective: The student will be aware of the importance of green plants.

Student Objective: The student will be able to give, in the body of a story, at least three reasons we need plants.

Conceptual Theme: Interaction and Interdependence

Materials:
- ditto
- crayons, scissors
- ditto, A green plant (17-1), one for each child
- hand lenses (optional)

Teaching Suggestions: Originate the activity by bringing in a green plant. Sweet potato plants work well. You can root them in a glass container filled with water. Add nutrients as needed. Keep it in a place where students can watch it grow.

After the students have seen this example of a green plant, you can begin the activities on the card. Start by completing the ditto. What parts does the plant have? If you wish, you can spend some time talking about the function of each part. The roots absorb water, the stems transport the water upward and food products downward, the leaves capture energy from the sun and manufacture food, flowers aid in the formation of seeds.

As you color the ditto, observe these parts on a real plant. You may wish to look closely at the tiny root hairs. Cut the stem of a plant; look at the cells for transporting water. Compare the top and bottom of a leaf; how are they different?

Talk about the things the green plant needs for healthy growth. Add them to the picture. If you have a plant growing in water, this would be a good time to lay to rest the theory that plants need soil. Plants need nutrients; they can get them from water as well as soil.

Go through the list of things green plants can do. Can you do all these things? Go outside and observe green plants. Can you see them doing all of these things? You may wish to have students try to prove one of the ones they cannot see (taking in water).

Green plants are important for many reasons: They alone can take energy from the sun and convert it into food, they remove carbon dioxide from the air and replace it with oxygen, they add water vapor to the air and cool it, some plants enrich the soil with nitrogen, they prevent erosion, they add beauty. Additional activity cards focus on plants as producers of food, adaptations of seeds, beauty of plants, and commercial uses of trees (see index).

General Objective: The student will be aware of the different modes of transportation in seeds.

Student Objective: The student will collect at least six different types of seeds and classify each as to method of travel.

Conceptual Theme: Similarities and Differences

Materials:
story, "A Mighty Seed," (18-1)
information card, Seed Travelers (18-3)
hand lenses
coconut (optional)
seeds found in the environment

Teaching Suggestions: You may wish to time this card to coincide with the dispersal of seeds in your area. Observe the plants in your area for evidence of seed formation.

Start the card with a walk around the school. Look at the different types of plants you find there. Ask the students how they think the plants got there. Were they all planted by man? What are some other ways plants can be introduced into an area? The book, Seeds by Wind and Water, would be excellent reading after the initial discussion. This might be a good time to start making a chart that lists the ways seeds travel. Later, the students will try to classify the plants in your area using the chart.

Discuss the first two items under the "Do More" section. Most of the answers are contained in one or more of the resources.

The story, "A Mighty Seed" is about the coconut. See if you can find a coconut for the class to study. Start by floating it in a container of water. If it is one you can destroy, try removing the husk. You will find it is very hard work. The coconut is well protected by nature.

Talk about other ways plants can be started. This would be a good time to visit a nursery or have someone from the nursery, the department of agriculture, or a local garden club visit the class. Have them illustrate some of the ways new plants can be started from cuttings, air layering, or grafting.

For the evaluation, have a seed hunt. Before you start, prepare a large chart with the methods of travel listed across the top. Have the students observe local seeds for methods of dispersal. You may wish to add other seeds like corn, peas, oranges or other fruits. Have the students collect the seeds. Then have them decide which column to put the seeds in. Glue them to the chart.

General Objective: The student will be aware of the details of one tree.

Student Objective: Based upon observation, the student will be able, in story or poem format, to list his discoveries about a selected tree.

Conceptual Theme: Change and Adaptation

Materials:
- paper and pencil
- newsprint
- crayons or charcoal
- printing ink or tempra paint
- brayer
- hand lenses
- information card, Things That Need Trees (19-1, 2) (one copy per student)

Teaching Suggestions: This card and number 20 focus on trees. The two can be done together. The object of this card is to have the students really get to know one tree. If you do not have many trees on your campus, the students may need to observe a tree at home or on the way to school.

Before you begin these activities, you may want to make a large tree for the bulletin board.

Read the poem on the cover of the card to the class. Of course, the best place to read the poem is under a tree. What was she trying to say about the tree? How do you think she felt about the tree?

Have the students make a booklet about their tree. It should include their log of observations and discoveries about the tree. This activity will not succeed unless you schedule adequate time for observation. Look for signs of age, weathering, condition.

The tree sketches can be done in crayon or charcoal. Black charcoal on newsprint produces a lovely sketch. The rubbings of the bark can be done at the same time. Have the students observe the bark closely. What evidence do you see of animals that are living in or under the bark? What scars do you see?

There are many ways to make leaf prints. Two of the most satisfactory are ink and tempra prints. Begin by squeezing a half inch of printer's ink on a glass square. Spread it into a thin, even layer by rolling the brayer over it in all directions. Place a leaf, vein side up, on a piece of newspaper. Ink the veins with a rubber roller. Place the leaf, inked side down, on a sheet of clean paper. Cover it with a piece of newspaper. Roll the rubber roller over the newspaper, pressing the leaf under it firmly against the printing paper. Remove the newspaper. Pick up the leaf carefully so that you do not smudge the print. The procedure is the same for tempra prints, just substitute a thick tempra mixture.

Try to use a variety of leaves for the prints. You might have to write to other areas for leaves not found in your region.

The simplest way to estimate the age of a tree is by looking at the branches. The tree must be at least five feet tall. Look up into the tree. The branches should form a swirling pattern. Each set of branches, or swirl, represents one year. Another way to find out the age of the tree is by taking a core bore. This should be done by someone from the forestry service. Contact them for further information. If there is a tree in your area that has been cut, study the trunk. You should be able to see growth rings. Most trees add a ring every year. You can also compare the conditions for each period of time by looking at the width of each ring.

Run off the ditto, Things That Need Trees (19-1) on construction paper for the students. Have them cut out, assemble, and color the trees. Add the creatures that need the tree. Talk about why each animal needs the tree. What animals can they add from their observations? Do any of the animals harm the tree?

For the evaluation, have the students write a poem or story about their tree. This would be a good time for them to try to cinquain (see card number 12). Post the completed products on the tree bulletin board or include them in the students' booklet.

General Objective: The student will be aware of the importance of trees.

Student Objective: The student will be able to construct a poster showing at least four reasons we need trees.

Conceptual Theme: Interaction and Interdependence

Materials:

- thermometer
- paper and pencil
- hand lenses
- wood
- sandpaper
- oil
- magazines
- glue
- scissors
- construction paper
- markers or crayons

Teaching Suggestions: This card should be used in conjunction with card #19.

Depending upon their prior experiences, the students may need help in taking temperature readings. This would be a good time to assist them. After they have taken the readings (for several days, if necessary) have them talk about their conclusions. The tree adds water vapor to the air in addition to oxygen. (Don't tell them this; let them puzzle over their discovery.) This is one reason trees are so important.

You will need a hand lens for each group of students. Have them examine both the top and underside of the leaf. Have them look for the differences. The underside contains pores which allow air and water vapor to pass back and forth from the leaf. Some of the references listed have illustrations of the pores.

You can usually get lumber scraps from lumber companies. These are suitable for the purposes of this card. Before you sand the wood, you might try making prints using the end of the wood. This is another way of illustrating the cellular structure of the wood. Allow the students plenty of time to sand and work with the wood.

Talk about all the ways trees are used commerically. Forestry is a big agriculture business in many states. The wood is used for building products and for paper. Information card 23-7, Recycling Saves Trees shows some of the steps involved in making paper from trees. You might want to discuss it at this point. Some of the references listed for this card are helpful here also.

The State Division of Forestry has free films available on trees. Contact them for further information. Some forestry offices also have resource people available to work with schools. This might be a good time for the class to plant a tree. Contact the State Division of Forestry for details on a tree for your school. Be sure to emphasize that a tree needs care after it is planted. Review with students things green plants need. Set up committees to care for the tree.

For the evaluation, have each student or group make a poster showing all the reasons we need trees. Discuss them.

Student Card #21

General Objective: The student will understand the meaning of the word litter.

Student Objective: Based upon information collected, the student will list, try and evaluate at least three ways the amount of litter on the school grounds can be reduced.

Conceptual Theme: Interaction and Interdependence

Materials:
- ditto of litter maze (21-1), one per student
- data sheet (21-2), one per group
- grocery bags (from home), one per group
- crayons
- glue
- scissors

Teaching Suggestions: Originate the activity with the maze provided. Discuss with the students what litter is and what causes it. Talk about the things we can do to prevent litter. Someone will probably suggest making litter bags and picking up litter around the school grounds. Suggest that they bring grocery bags from home for this purpose, since they often end up as garbage. Divide the students into working teams. Let each team decorate their litter bag. Assign each team an area of the school yard to cover. You might wish to have a large map of the school yard showing the area each group will cover. (This would be a good map-making activity for the older students.) Give each group a data sheet for recording observations (optional). When the students return, have them dump their litter on their section of the map. Talk about the types of litter they found. If any of the groups brought leaf litter or natural debris, this would be a good time to talk about what happens to natural litter. Classify the litter by types. You may wish to use the litter collected in this activity to set up a composting heap. The students can observe how the process of decay works on natural materials, but not on many man-made ones (see index for composting).

There are a number of art activities you can do with litter. You can make garbage monsters from litter collected, litter collages or pictures, mobiles with slogans and litter combined.

For older students, you can try weighing the litter collected or measuring the volume. This gives you a good way to evaluate the results of your efforts. Younger students can simply tabulate amounts found before and after.

Try making a list of ways the students can reduce litter on the school yard. Carry through with these ideas. This might be a good time to talk about recycling (see index).

For younger students, you may wish to add this vocabulary exercise. Make a large litter basket for the bulletin board. Make litter words to go into the basket; for example, garbage, litter, trash. Have children use the words in sentences. They may wish to record anti-litter messages for other students using these words.

See resources for this card for records, books, and filmstrips on this activity.

Student Card #22

General Objective: The student will understand the role of decay in changing natural litter.

Student Objective: Based upon evidence collected, the student will be able to predict which items in a garbage pile will decay.

Conceptual Theme: Change and Adaptation

Materials:
shovel
garbage, grass clippings, litter
thermometer
poster paper (for record)

Teaching Suggestions: This card addresses the problem of what happens to natural materials. This activity emphasizes that decay is a natural process. Natural materials decay constantly, and their nutrients return to the earth, thus completing a natural cycle. Decomposers are responsible for this. Decomposers are investigated on card number 42. Many synthetic materials, however, do not decay and these present a problem.

There are several ways to construct a compost. Directions are given here for a long and short method. Have the students dig a hole approximately 2 x 6 x 3 feet. Alternate layers of garbage and dirt. (NOTE: The compost will not smell if meat is excluded.) For a shorter method, begin by blending or cutting up the garbage parts before adding. Also turn the compost every day or two.

The temperature of the compost should rise as the decay action proceeds. The breaking down of natural materials produces heat. When the action of the decomposers is finished, the temperature will return to normal.

Begin the composting activity by recording everything that goes in. Older students may want to weight or measure the volume of the garbage. Record also the temperature of the compost on the first day. Keep a daily log of the temperature and action taken on the compost. Every four days, dig up a small portion of the compost. If you use the fast method of composting, the compost should be ready in approximately two weeks. The students should compare their findings with the items originally placed in the compost.

After the activity is completed, be sure to use the compost. It makes an excellent fertilizer. For further reading on this topic, consult the reference section of this guide. The Ranger Rick article listed is excellent.

This card can be used in conjunction with the one on niches in a food web (42) as an illustration of the work of decomposers.

General Objective: The student will understand the concept of recycling.

Student Objective: Using throw-away materials, the student will make a useful or decorative item. He will also list at least 5 ways materials can be recycled.

Conceptual Theme: Interaction and Interdependence

Materials:
information card, Recycling (23-1)
information card, Paper Recycling (23-7)
trash items from home
scissors
markers
string

Teaching Suggestions: Card #22 provides a natural lead-in to the problem of throw-aways and the concept of recycling.

The concept of recycling is introduced here with a contest for using trash. You probably have many ways you reuse items in the classroom. Call their attention to these. Here are two additional ideas you can introduce:

a) Plastic containers from liquid bleach, milk, and fabric softener can be used for storing classroom items. Cut off the top with a hacksaw. The upper portion of the container can be used for a funnel.

b) Styrofoam meat trays and egg cartons can be used to produce a number of art displays. Patterns can be cut from the trays and used to make mobiles. Color the cut-outs with marking pens. Use as a theme the special holiday for that month; save for next year.

The Do More section presents several ways of looking at the garbage problem. Having the trash collector take the trash away daily doesn't solve the problem; it merely moves it. Call your trash collector to find out what he does with trash. This would be a good time to read the information card, Recycling.

If there is no recycling plant in your community, you can use the information card, Recycling Paper or one of the excellent free resources listed for this card. This information card presents a very simplified picture of recycling paper.

The information card on recycling centers gives the locations and rates for used aluminum and paper in Brevard County. These are not recycling plants, merely pick-up points. The aluminum is suggested as a project since it produces quicker results and requires a minimum of storage space.

Student Card #23

As an optional investigation, you can have the students record the number of throw-away containers their family uses in one week. Give them a data card to post by their garbage can. You can then figure the number for the class, number for the month, year, etc.

Recycling Centers in Brevard County

Aluminum
Reynolds Aluminum
U. S. 1 - Montgomery Ward Parking Lot
Cocoa, Florida
Price---10¢/lb.
Monday at 10:00 A. M.

Paper
East Coast Paper Stock (636-1741)
U. S. 1, South
Rockledge, Florida
Prices -- Newspaper: 60¢ @ 100 lbs.
Mixed : 60¢ @ 100 lbs.
IBM cards : $3. 00 @ 100 lbs.
Hours 8:00 A. M. to 4:15 P. M. daily
8:00 A. M. to 12:00 P. M. Saturday

General Objective: The student will understand the concept of the water cycle.

Student Objective: The student will be able to show, by means of a drawing, how water gets to his house, at least 5 ways it is used there, and where it goes from his house.

Conceptual Theme: Interaction and Interdependence

Materials:
ditto of water cycle parts (24-1, 2), one for each student
crayons
magazines, scissors, glue
construction paper
wet cloth

Teaching Suggestions: Originate the activity by asking the students to list all the ways that they use water at their house. Make a class list. Have them try to guess how much water they use in a month. Have them ask their parents to look at their last water bill for the amount they really used. Consumption is usually listed on the bill in thousands of gallons. You may need to fill a gallon container for the class to help them visualize how much water they are using.

If you do not know the source of water for your area, you can usually get this information by calling the water department that serves you.

Now that the students have an idea of how much water they use, ask them where the dirty water goes. Find out where the waste water treatment plants in your area are. Man cleans dirty water by speeding up nature's process. However, most waste water treatment plants do not clean the water completely. For more information on this topic, see the references or the intermediate CEL Blocks.

Nature's way of cleaning water is the water cycle. Have the students construct and color their own water cycle. Remind them that the word "cycle" means wheel. Have the students trace the water drops. They can start at any point, since this is a cycle. The following processes are shown:

1) Water, in the form of rain, hail, snow, or sleet falls to the earth (precipitation).
2) Some water soaks in the earth and is stored there (ground water). Wells use this water. Other water runs off into streams, lakes and oceans.
3) Heat from the sun, or other sources, turns the water into gas, water vapor. This is called evaporation.
4) The water vapor gathers in clouds. This is called condensation. Condensation can be shown by placing a glass of ice cubes in the classroom. The air around the glass is cooled and moisture from the air condenses on the glass.

You can help students visualize these processes by simple demonstrations. For evaporation, heat water in a clear, open container. Some of the water will condense along the sides. Cut off the heat and cover the container. Some of the water vapor will condense and fall back (precipitate) into the container.

While the water cycle cleans water, it is a slow process. Man uses water much faster than it can be cleaned by nature. Thus, man must invent ways to clean water.

The students can carry out the investigation on evaporation in class.

The Ranger Rick article listed in the resources is an excellent compliment to this card.

You can do the What Now? in a number of ways. You might divide the class into three groups and let each do a section of a mural to answer the questions or let each student do an individual drawing.

Student Card #25

General Objective: The student will be aware of animal homes on the schoolgrounds.

Student Objective: Given pictures of six animals and their homes, the student will correctly match each animal with its home.

Conceptual Theme: Similarities and Differences

Materials:
- tape recorder or pencil and paper
- long stick (one for each group)
- story, "The Beaver" (25-2)
- ditto, Animal Homes (25-1) (one for each child)

Teaching Suggestions: Originate the activity by talking about animal homes. There are several excellent film strips listed, as well as books (see resources). Talk about the types of animals that might be found on the school grounds or nearby. The information card on vacant lots (see index) has information on some common school yard animals. Divide the students into groups. Have children go outside to look for animal homes. Caution the children not to put their hands anywhere they cannot see. Logs and rocks should be turned over with sticks rather than hands. The homes should not be destroyed, but observed. Explore the gound, trees, buildings, rocks, beach area, rotten logs, etc. Have the students record on the tape recorder or on paper a description of the animal home, its location and surroundings, and the animal that lives there. If enough information is gathered, you might be able to draw conclusions as to what animals could be found in certain environments.

The story about the beaver and its home is included for use with the Do More section. The muskrat is another interesting animal to read about. There are also additional stories about animals and their homes listed in the resources.

The children can select any animal that they are interested in for building a model of their home. A box top serves as a useful container for the home. Have the students add the natural environment found around the home.

Directions for building homes for ants and earthworms are included in these cards (see index). Bird houses and feeders are easy to make. Ant Lions can be kept in a sandy dish. Their homes are also their dinner tables. Students should consult hobby books for other homes. Be sure to include only those animals that can be cared for.

Copy the ditto for evaluation. After the students have completed the evaluation, discuss each of the animals and its home.

Student Card #26

General Objective: The student will be aware of the pattern of interaction between the earthworm and the soil.

Student Objective: The student will show, by means of a drawing, one way earthworms help the environment.

Conceptual Theme: Interaction and Interdependence

Materials:
- plastic jars, sand, and humus (one for each worm home)
- earthworms
- hand lens
- paper and pencil
- tape recorder
- newsprint

Teaching Suggestions: This experience will be more meaningful if the students collect their own earthworms. If the entire class participates, collect only enough earthworms so that the children can see them in the jars. The teacher should do some investigating beforehand in order to determine where worms can be found. If you did the composting activity earlier, that might be a good place to look. Worms will be closer to the surface after a rain. Look in places rich in humus which stay damp a lot. You might want to carry along some earthworms in case none can be found. If you cannot find earthworms in your soil, they can be obtained from a local fresh water bait store.

This activity can be done in connection with the activity card about the vacant lot. As the students investigate the soil, they may find earthworms accidentally. If they don't, ask them if they think any life exists in the soil. They will probably mention earthworms. Allow them to try out their own predictions about where earthworms will be found.

Earthworms seldom leave their underground burrows. At times they extend their anterior end out of the ground to find parts of plants on which to feed, or their posterior end to deposit small piles of coiled dirt called "castings." When leaves are not abundant, the earthworm takes its nourishment from organic material in the soil. He does this by ingesting the soil and digesting organic materials in it (decayed plant material, seeds, eggs, or larvae and the bodies of small insects). What is not retained passes out the anus to make castings. The digestion of food from the soil helps cultivate the soil because the earthworm has a gizzard which grinds up what the worm ingests. Since this includes both soil and the remains of uneaten bits of leaves previously pulled down into the ground, this becomes mixed in the process of grinding. Earthworm castings thus enriche the soil for plants. The burrows of the earthworms also aerate soil.

Earthworms breathe through their skin. In hot weather they avoid drying by staying far below the surface. In cold weather they close off their burrows from the upper air and go to a widened chamber at the bottom of the burrow where several worms may be all rolled up together. In rainy weather worms may come to the surface because of a lack of oxygen. Although earthworms can live for some time in ordinary water, the water that filters down through the earth loses its oxygen and fills the burrows so the worms are unable to breathe.

Earthworms have a closed circulatory system with 5 aortic arches or "hearts," a nervous system with a brain, a tubular digestive system with a gizzard and a crop. Earthworms are hermaphroditic: each contains both male and female reproductive systems. They do, however, mate and cross-fertilize one another. Earthworms contain photochemical receptors in their skin; they are sensitive to light.

The suggestion about covering the container is to make the container dark. This approximates the natural environment of the earthworm. They will build their burrows closer to the sides this way.

After the students are through studying the worms, they should be returned to the soil. This would be a good time to discuss the contributions of earthworms.

This card can be used in conjunction with the activity card on niches in a food web. This will tend to put the earthworm in the proper perspective.

Consider inviting someone to talk to the class who raises earthworms, or if possible, visit a worm ranch.

General Objective: The student will be aware of insects in the environment.

Student Objective: Given pictures of six animals, the student will be able to correctly identify those which are insects.

Conceptual Theme: Similarities and Differences

Materials:
- information card on insects (27-1)
- tape recorder (optional)
- clay, playdoh, or styrofoam balls
- pipe cleaners
- tissue paper
- story, "A Good Survivor" (27-3)
- books on insects (see resources)
- evaluation ditto, one for each child (27-2)

Teaching Suggestions: Insects are abundant everywhere. Insect species number about 700,000. Have the students read the information card on insects before they go looking for insects. Insects have three body parts: head, thorax, and abdomen. Their six legs are attached to the middle section, or thorax. Insects have antennae, or feelers, attached to their head. Most also have wings attached to their body. The information card shows the life cycle of the Drosophila melanogaster, or fruit fly. This cycle is representative of insects that undergo complete metamorphosis: egg, larva, pupa, and adult. Caterpillars are really the larvae of insects. Other insects, like the grasshopper, undergo incomplete metamorphosis: egg, nymph, adult. If the opportunity exists, the students would probably enjoy watching at least part of this process. See references for more information.

The hunt for insects should be no problem, since they are so abundant. Encourage the students to look for the larva and pupa stages of insects as well. If you find a chrysalis or cocoon, bring it back to the room and place it in a large jar or terarrium. When the adult emerges, release it. You might also try the larva stage if you can find the type of food it prefers. You may wish to carry out your hunt for insects in conjunction with the cards on animal homes or vacant lots.

Use styrofoam balls, clay, or play doh to make bodies for your insect models. Use pipe cleaners for legs and feelers, tissue paper for wings.

Many insects are helpful to man. The ladybug and honeybee are only two examples. The book, Ladybug, Ladybug, Fly Away Home (see resources) explores some ways the ladybug is helpful. It is a good story to read to the class. The cover of this card is a maze. Have the children add the legs to the ladybug (6) and spider (8) and then help the ladybug out of the web. A grove owner might be willing to tell the class why they keep honeybees, but try to kill other insects.

The story on the cockroach illustrates some of the reasons that insects have been so successful in surviving. It illustrates, too, that many insects eat some of the same foods as man. We often find ourselves competing with insects of food. In cases such as this, man has often resorted to the use of pesticides. The cockroach is a living example of the inability of pesticides to wipe our insect species. If you wish to pursue the point on pesticides further, consult the index for other cards on this topic.

The resources listed will give the information on insects as predator and prey. Many insects eat plants or plant parts: this is particularly evident in the larva stage. Interestingly enough, many insects eat other insects: dragonflies eat mosquitoes, ladybug beetles eat aphids, praying mantis eats lots of insects.

This card can easily be tied in with the one on food webs (see index).

Insects protect themselves in a number of ways: many use protective coloration, most can fly, others are fast. You can add more ways to the list.

The evaluation ditto has six animals on it. Only the mouse and spider are not insects.

The Wensberg book (see resources) has experiences for primary age children with insects as well as a bibliography and stories about that animal.

General Objective: The student will be aware of the importance of spiders.

Student Objective: Based upon information collected, the student will be able to list at least two reasons spiders should not be indiscriminately killed.

Conceptual Theme: Interaction and Interdependence

Materials:
- clay, play doh, or styrofoam balls
- pipe cleaners
- enamel spray paint (black or white)
- construction paper (yellow or black)
- clear-drying fixative or lacquer spray

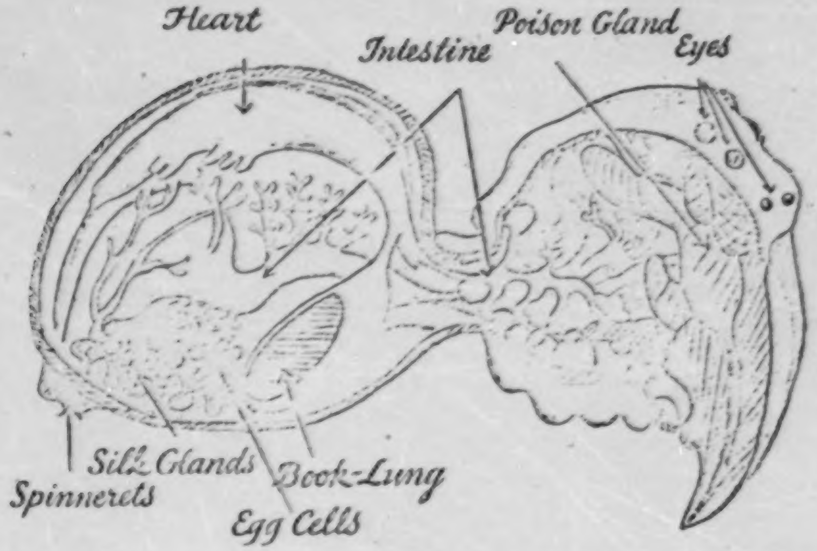
Teaching Suggestions: There are about 15,000 known species of spiders. Spiders belong to the animals known as arachnids (ah-RACK-nids). Insects and spiders are relatives of the same family, or phylum, called arthropods (R-throw-pods). Other members of the arthropod family include crabs, lobsters, and centipedes.

The best time to go looking for spider webs is in the early morning when the dew settles on the web and makes it easier to see. Webs are strong and elastic, but they will break so test them gently. You may be able to see evidence of dead insects in the web, or ones that have been "packaged" in silk. When you are out looking for webs, you may wish to make a web print. If the spider is in the web, blow on it and it will usually run off. Hold the enamel spray at least 10 inches away and carefully spray the web on all sides several times. Cut the construction paper slightly larger than the web. Spray the paper with a fixative or lacquer until it looks wet. Place it against the web; it will stick to the paper. Break the web off around the edges of the paper. One web is enough for illustration.

After the initial observation, watch the film Spider Engineers, read a book about spiders, or use some of the Ranger Rick articles. The film is excellent student viewing. It illustrates web making, food gathering, and many interesting habits of spiders. It may be too long for younger students.

The main food of spiders is insects or other spiders. This way spiders act to help keep the insect population as well as their own under control. Spiders do not actually eat their prey. The suck the body juices from them after injecting them with poison. Not all spiders catch their prey in webs. Some insects, like the praying mantis, eat spiders. They are also eaten by frogs, toads, and birds----as well as other spiders. To see how this fits into the balance of nature, you may want to do the card on food webs (see index).

The anatomy of a spider is discussed in the Hogner book, Spiders, as well as encyclopedias. Briefly, the spider has two body parts: A cephlo-thorax (head-chest), and abdomen. There are four pairs of legs, all attached to the cephlo-thorax. The spider does not have feelers but does have two pedipalphs for grasping food and two jaws, used for injecting poison. Spiders also have eight eyes, all placed on the head. The spinnerets are located on the tip of the abdomen. Most spiders are capable of spinning at least three types of silk.



The actual making of webs is discussed in the book Spider Silk and the movie Spider Engineers (see resources). The Ranger Rick article also has a maze that shows how an orb spider spins a web. The children can act this out by using thread or kite string. They might also want to act out the catching of food.

Most mother spiders die before the young are hatched. The mother spider prepares for this by carefully packaging the young - and the food they will need.

General Objective: The student will be aware of local birds and their adaptations to the environment.

Student Objective: By means of a drawing and report, the student will give the following information about one bird: its appearance, its foods, and its environment.

Conceptual Theme: Change and Adaptation

Materials:
booklet, "City Birds" (29-1 through 29-6)
material for bird feeder (see teaching suggestions)
bird books (see resources)
construction paper
crayons
writing paper

Teaching Suggestions: Begin by posing the question: Why would a bird prefer the city to the forest? The students may have some ideas they can discuss. After the discussion, tell the students they are going to hear about some birds that are city dwellers. The booklet, City Birds, can be used at this point. Some of the references give additional information and pictures on these birds. For younger students, you may want to have them color the pictures of the birds while you read the information. This booklet explores the ways six birds have adapted to changes in their environment. Some of the birds may not be familiar to the students, but the point is to appreciate the ways they have been able to adapt to man's environment.

The Do More section has several lengthy projects. You may wish to make the present and wait for several months to complete some of the observational activities.

The "present" mentioned is a bird feeder. There are many types you can make. The directions for five types are given below:

1) Pine-cone feeder. Materials: pine cone, peanut butter (or suet or shortening), bird seeds, raisins, string.
Stuff peanut butter or other fat into the pine cone (do not mix fats). Roll it first in bird seed then raisins. Attach string to the top of the pine cone and hang.

2) Paper cup hanger. Materials: paper cup, bacon fat, bird seed, string. Place a string in the paper cup and loop over top. Pour melted bacon fat into a cup when just warm. Add bird seed and mix it up. Refrigerate and let set overnight. Rip away paper cup and hang where birds can see it. Note: This feeder will melt in hot weather.

3) Plastic jug or milk carton feeder. Materials: plastic jug or milk carton, scissors, bird seed, string. Cut out two sides of the container. Hang by top to tree. Put bird seed in the bottom. Attaching a metal pie plate to the milk carton provides a perch for the birds.

4) Bread in a wire cage. Materials: wire mesh, string, and bread. Make a small circular wire cage using some type of open wire mesh. Stuff bread pieces in the mesh. Hang.

5) Suet on a string. Materials: suet, string. Hang suet from tree or or tie to limb.

This activity cannot be accomplished in a short period. It is best to hang the feeder where it can be seen from the classroom and schedule observation time as needed. You can divide the class into groups, and let each group make a different bird feeder.

There are several good resources listed in connection with this card which will aid students in identifying the birds they see. Some of the birds they will see are especially suited for life in this area. Notice leg length, foot shape, bill shape.

By keeping a log of the birds they see, students should be aware of both the migratory and permanent birds in this area. Migration is another example of adaptation to a changing factor in the environment.

The problem of animals that cannot adapt is explored on the information card, "Florida's Endangered Dozen." (see index) You may want to read about the birds that are endangered at this point. These animals are endangered because of loss of territory or loss of prey. Man is largely responsible for these changes.

The What Now section provides an opportunity for the student to research and report on just one bird. The finished picture and report should be displayed for the rest of the class.

Student Card #30

General Objective: The student will understand the needs a good zoo fulfills.

Student Objective: The student will describe, by means of a story, at least two problems a caged animal experiences.

Conceptual Theme: Interaction and Interdependence

Materials: pieces of string 50" long, one per student
information card, The Zoo-A Special Place (30-1)
information card, How Good is Your Zoo (30-2)
paper and pencil
story, "Zoo Doctor," (30-4)

Teaching Suggestions: This card explores the needs of animals in captivity. The first need explored in the To Do section is that of stimulation. You can accomplish this section in several ways. One is to have the students try to stay within the circle, perfectly still for 5 minutes. An alternate way would be to let them suggest how long they think they can stay in the circle perfectly still. Let each student contract for a specified length of time. Discuss their feelings about the experience. How would they feel if they had to do this all day, every day.

It would be an excellent time to visit a zoo in your area and rate it. At the same time study the animals. The zoo card explains what a zoo should do and how to rate a zoo. Depending on the grade level of your students, you may find it necessary to help them in rating the zoo.

Discuss the questions on zoos fully before you plan to visit. Go over the rating sheet with the students. Be sure they know what they are looking for. Try to arrange to have people from the zoo available to talk to the students.

If there is no good zoo in your area, investigate the possibility of visiting a wildlife sanctuary. They fulfill many of the functions discussed under zoos.

The actual rating of the zoo seems to work best if you organize the students into groups, give them the data sheet and pencil on a clipboard, and let them go about their task. Having the data sheet in from of them helps them remember just what they are looking for.

Read the story of the zoo doctor to the students. Discuss how animals take care of themselves in nature. There are no doctors there. The weak and sick die; the healthy live. The animals that live continue a strong species. If all of the animals die, the species will disappear. There are many species, today, that are in danger of disappearing. In most cases this is not due to sickness, however.

Student Card #30

This is an excellent opportunity to have a guest speaker. Invite a veterinarian and have him discuss what diseases pets have most. Have him tell the class about good pet care. After the veterinarian leaves write experience stories about what they learned from his visit. You might also visit a pet shop or zoo and talk to someone about the care of the animals.

Discuss how a caged animal must feel and why they pace their cages. Write a story about a caged animal. List some of the problems the animal faces. Display the stories. Try this for a novel touch: Have children color a picture of the animal in the wild and then paste it on a large sheet of paper. Cut black strips to paste over the picture to resemble a cage. Put up on bulletin board and put story up underneath it.

For younger students, prepare a bulletin board like a cage. Let them draw one animal from the zoo. Let each student place the animal behind the bars. Discuss the problems the animal would face.

Student Card #31

General Objective: The student will understand and appreciate the reasons animals groom themselves.

Student Objective: The student will be able to name at least two animals and show the way each grooms itself.

Conceptual Theme: Similarities and Differences

Materials: booklet, "Do I Have To Take A Bath?" (31-1)
books on grooming (student's level)
newsprint, crayons
materials for puppets

Teaching Suggestions: The point to be made here is that grooming is universal. All animals groom including humans. Originate the activity by using the booklet, "Do I Have to Take a Bath?" For younger students, you might reproduce the pictures for them to color while you read. This can be a good lead-in to a health unit. Encourage students to read books on grooming. The students should also be able to use story paper effectively after reading the short stories on the different animals and how they groom themselves.

Many classes have done puppet shows and plays using the subject matter from the booklet. You can supplement it with information collected by the students. Have the students make their own puppets or props.

They should be able to write sentences using the vocabulary describing animal grooming. The list is as follows: scratch, brush, splash, comb, roll, shake, preen, bake, wash, sharpen, dust, squirt, clean, twist, and others you might wish to add.

The study prints listed in the resources provide an addition source of pictures for the class. The words and the pictures can be used for a matching game. Divide the students in small groups. When the picture is flashed, have them select the proper grooming word. Assign points.

Observations on grooming may be made in conjunction with a visit to a zoo or pet shop. Students can compare these observations with those on their pets. You might have students bring in caged pets; i.e., gerbils, parakeets. Have class observe them grooming.

You might want to make a large chart for each animal you discuss. In addition to describing how the animal grooms, list the foods it eats, its habitat, and means of protection.

Student Card #32

General Objective: The student will be aware of the importance of sand in the environment.

Student Objective: Using a method of his choosing, the student will be able to illustrate at least one reason sand is important.

Conceptual Theme: Interaction and Interdependence

Materials:
- sand
- tempra powder (several colors)
- salt shaker
- liquid glue
- heavy paper
- hand lens
- coquina or other sedimentary rock
- water

Teaching Suggestions: Begin by making sand pictures. Have the students prepare several different colors of the sand-tempra mixture. Add just enough tempra powder for color. Make interesting designs with the glue before adding the sand. Use the picture to examine both the texture and physical structure of the sand.

The rock rubbing activity is designed to show how weathering can break down large particles into small ones. Any sedimentary rock will do. This is one way sand is made. There is a story, "Where the Sand Came From," in the Wensberg book (see resources). It is a good story to read to the class.

This is an excellent opportunity for a trip to the beach. Before you go, read the teacher information card on beach dunes and the ocean beach. This information will help you when you get to the beach. If you do not live near a beach, try to obtain a film or filmstrip on life at the beach. Look for animals that feed on the beach as well as plants and animals there. The plants help anchor the sand and slow wind and water erosion. The beach itself protects areas further inland. Our local beaches are known as barrier beaches for this reason. Leveling the beaches, destroying dunes and vegetation destroy the natural function of the beach.

Sand has many commerical uses. It's principal use is in the making of glass and glass products. Have the students read the story "Castles and Mirrors and Cities of Sand." This story explores the uses of sand.

Beaches are in a constant state of change. Wave and wind action move the sand from one location and deposit it in another. The new location may be another beach, on the middle of a channel, or on a sandbar.

Let the children use their imagination in showing the importance of sand. They can plan a simple display, report, etc. for the rest of the class.

BIOTIC COMMUNITIES IN BREVARD COUNTY
OCEANIC REGIONS

From the shoreline the ocean floor slopes gently away forming the continental shelf. On the Atlantic coast the width of this shelf is over 100 miles at Jacksonville, Florida. It grows more narrow heading south being about 26 miles wide at Cocoa and only a few miles in width at Miami. Two major habitat zones make up this region, the neritic zone, or open water above the continental shelf, and the littoral zone, the sea floor from the shore to the edge of the continental shelf. The depth of these waters varies from a few feet near the shore to over 100 feet at the edge of the continental shelf.

THE OCEAN BEACH: THE TIDAL ZONE

The beach is the longest, narrowest, and easiest to identify of all the communities. It is a ribbon of sand covered and then uncovered by the ocean's tides twice each day. The action of the waves keeps the tidal zone free of land plants while the drying action of the sun and air during low tides limits marine algae. Even so, a surprising number of different living things inhabit the beach.

In rocky areas* the marine algae cling to the bottom with well adapted holdfasts. Species found on our rocky shores include the limpet, the sea anemone, and the starfish.

Most of the beach is sandy, however, and many animal species have adapted themselves to this continuously changing environment. Of particular interest is a small mollusk called a coquina. This species and the sand flea prefer the wave-washed area of the beach. Here the wave action provides these species with a constant supply of plankton.* Both the coquina and the sand flea are a source of food for shore birds and fish. The shorebird species include the ruddy turnstone, the sanderling, and the knot. These birds are often seen during feeding, running up and down the beach following the wave action.

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*Most of the rocky area on our shores is composed of coquina, a cemented mixture of sand and sea shells. This is a geologic formation of the Ice Age that extends for 150 miles along the east coast of Florida. A small mollusk of the seashore is also known as a coquina.

Information adapted from Teachers Curriculum Guide for Field Ecology,
Brevard County Center for Environmental Learning, 1971.

Another source of nutrition on the beach is wrack. Wrack consists of a great variety of dead and dying marine plants and animals cast up by the sea; it is also made up of upland vegetation that has been washed into the sea. Some living things in wrack include the massive floating brown algae, Sargassum, a great variety of dead fish; the long cigar-like seeds of mangrove tree and the colonial cnidarian, the Portugese man-of-war. Wrack attracts scavengers such as the nocturnal ghost crab and a variety of insects which feed on the dead organisms. The scavenger insects attract other insect species which feed on them, the most prominent being the tiger beetle, a beach species with large jaws and wings well suited for rapid controlled flight and is a common sight on warm summer days.

Man can also be found living on the beach. He uses it for sunbathing, recreation, and even as a thorough-fare for motor vehicles more and more. How will this affect the other living members of this complex community? We do not know.

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*plankton - tiny, drifting or weakly swimming plants and animals.

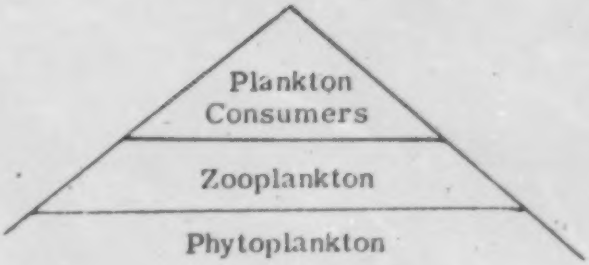
THE NERITIC ZONE

Most of the neritic zone allows the passage of enough light to support many phytoplankton, passively drifting or floating organisms that carry on photosynthesis. One type of single-celled phytoplankton is Gymnodinium brevis, the organism that causes red tides. Phytoplankton are the producers of the marine world and are the food base of this ecosystem. The first consumers of these microscopic forms are marine zooplankton which includes adult crustacea (copepods), larval invertebrates, and protozoa.

Student Card #32

Other consumers of plankton include larger invertebrates, small fish and even the giant baleen whales (sperm whales) which depend upon straining the plankton from the sea as their primary source of food.

Oceanic Food Pyramid



Another planktonic form is the Portuguese man-of-war (*Physalia*). The top of this marine animal is a gas filled float, or sail armed with extremely toxic stinging cells. *Physalia* stands between the plankton and the nekton which make up actively swimming animals capable of changing their positions at will.

Nekton includes fishes, whales, porpoises, sharks and rays. In our coastal waters common fishes are mullet, tarpon, Spanish mackerel, blue fish, red snapper and grouper. The mullet is a species that feeds upon marine algae while the others feed upon small fish and crustacea. All of these species are important food fish for man with the exception of the tarpon. The blue fish, for example, follow schools of migrating baitfish -- primarily menhaden and fingerling mullet. The blues group in large schools slashing their way through these fish, tearing them to bits, leaving little more than froth of tidbits and crippled fish for dipping, diving terns, gulls and pelicans that follow overhead.

THE LITTORAL ZONE

The littoral zone offers many environments for widely-different marine forms. The Florida littoral zone is sandy. These sandy shores are the result of the erosion, transport and deposit of the sediment at a location. These can be the reef beaches of wide coastal beaches.

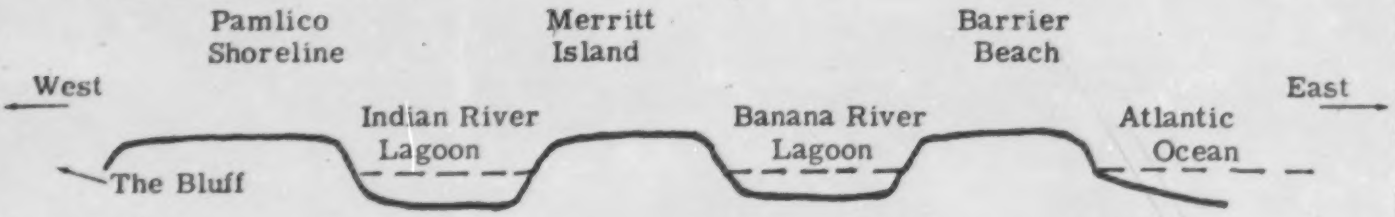
Marine populations in these areas are usually large, but because they are active at night are not usually seen. Small crabs, shrimp, snails and annelid worms live above the surf zone as well as offshore, beyond the surf zone. Oysters, clams, snails and worms provide food for higher order consumers such as shrimp fish, whelks, and starfish. Scavengers, such as the sea urchin and sand dollar, feed on the remains of many kinds of sea life.

Small marine life seeks shelter among sea grasses. In the deeper, cooler regions, where there is little sunlight, a brown seaweed offers a safe place for many sea animals.

The reef beach, a second form of built-up sand is found only on Florida's lower east coast. From Canova Beach to Biscayne Bay, heavy seas keep the water stirred up and cold, making it an ideal environment for the reef-building worm , Sabellariidae. This colonizing worm attaches itself to rocks or firm soil along a shoreline, forming reefs up to two feet thick. In the geologic past, this reef-building activity may have played an important part in beginning a chain of islands along Florida's coast. The reefs formed by the sabellariid worms provide a well-protected environment for the spiny lobster, crab, sea urchin and many fish.

BEACH DUNES

Our ocean beach did not always reside in its present location. In the very recent geological past the ocean shoreline was further inland and in most areas in Brevard County it was located along the west bluff of the Indian River. As the sea level dropped, sand bars were formed to capture two lagoons, the Indian and Banana Rivers, and to form the present barrier beach.



The differences between the plant community along the west bluff of the Indian River and along the present Atlantic beach probably represent the kinds of change (succession) that occur on beach dunes.

The dunes along our present Atlantic beach have the following plant zones: the sea oats zone, the palmetto zone, and the scrub zone. The front of the foredune* is dominated by pioneer species like sea oats, railroad vine and the silver-leaf croton. In the palmetto zone, usually beginning behind the foredune, we find saw-palmetto, sea grape, wax-myrtle and red-cardinal. Further back from the sea is the scrub zone which can develop into climax hammock. Here we find various scrub oaks, gopher apple, stagger bush and love vine, a parasite. Animals of the beach dunes include the lizard, the six-lined race runner, native species of mice and rats, the scrub jay, and ghost crabs. Even the female loggerhead sea turtle invades this community each June, laying her clutch of eggs above the high water mark usually on the face of the foredune.

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*foredune - the first in a series of dunes; the dune closest to the sea.

Reference:

Kirtz, Herman, Florida Dunes and Scrub Vegetation (Bulletin #23, State of Florida Department of Conservation, Tallahassee, 1942.)

Student Card #33

General Objective: The student will be aware of the plight faced by sea turtles.

Student Objective: The student will give, in a letter, at least one reason for the decrease in the number of sea turtles, and suggest one solution for the problem.

Conceptual Theme: Change and Adaptation

Materials: story, "The Case of the Disappearing Turtles" (33-1)
paper and pencil

Teaching Suggestions: The best time to use this card is when the turtles are laying their eggs (May-Sept.). Begin by reading the story, "The Case of the Disappearing Turtles." Discuss the thought questions with the students.

This might be a good opportunity to have a wildlife expert come in and talk about the sea turtles in the area and the ways they are being protected. An officer from the Florida Marine Patrol can give you information as to the law and the penalties.

The most familiar turtle to watchers in this area is the loggerhead. Green turtles, hawksbill, and leatherback turtles also inhabit this area. The type of turtle can be identified by the plates of scales on the top of the shell and head.

The loggerhead turtle, which usually weights well under 300 lbs., crawls on the beach to lay eggs twice a summer. It is best to go late at night (about 11:30 p.m.) and dress to prevent mosquito bites. The female turtles crawl above the high tide mark and begin to dig a flask-shaped nest. Once they have begun to dig, the presence of people will not bother them. Turtles usually lay approximately 100 eggs which resemble ping-pong balls. The egg laying usually takes about 2½ hours. The number of eggs layed and the number of crawls per season varies with the species.

The incubation for the eggs varies with the species too, but the turtles will hatch in 50 to 60 days. The young turtles leave the nest within 48 hours of hatching. Birds, land crabs, and man prey on young turtles when they are on land. In the water, various fish including sharks feed on the turtles.

The female turtles will not return to land until they lay eggs. The males will not return. The turtles mate at sea. Most of the sea turtles are omnivores eating fishes, prawns, bluegreen, algae, and jelly fish. The green turtle, however, eats only plants.

Student Card #33

The chief enemy of adult sea turtles is man. Different species are hunted for their meat, shell, or eggs.

Turtles are reptiles-cold blooded egg-layers with backbones. Other reptiles include snakes, lizards, alligators and crocodiles. The indigo snake and the American crocodile are endangered reptiles in the state of Florida. Information on these animals is given on information cards 53-5 and 53-19.

If you live in an area where there are no sea turtles, substitute an animal whose chief destroyer is man. Explore the reasons for this and see if the animal is protected in any way.

Student Card #34

General Objective: The student will be aware of footprints in the environment.

Student Objective: Given the pictures of footprints of five different animals, the student will correctly identify the human footprint.

Conceptual Theme: Similarities and Differences

Materials:
- black construction paper footprints
- construction paper large enough for footprints, one per child
- scissors
- evaluation ditto (34-1), one per child
- story involving footprints
- spray fixative
- flour or white tempra powder

Teaching Suggestions: This activity is designed to introduce the students to the concept of tracks. The activity should be done by at least five students at a time, and preferably, the entire class. The following card can be used as a follow-up to this activity.

For this activity, you will need to choose a story for the class that involves footprints. Before this activity starts, lay a trail of footprints from the class to the area where the story will be told. If the weather is nice, the outdoors would be an ideal area for the story. If this activity is done by only a group, the story can be put on tape.

Originate the activity by having the students follow the footprint trail to the story area. Then read the story. How are footprints used in the story? Ask the students if they can identify their own footprint. Have them trace the outline of their foot on construction paper, or make footprints on black construction paper. To do this, dampen one foot, dip it in flour or white tempra powder, and then place it on the paper. Spray with a fixative.

Although human footprints have the same general shape, footprints can be used for identification. Perhaps one of the children can bring from home a birth certificate from the hospital (not to be confused with a certificate of live birth issued by the state). The hospital certificate has the child's name and footprint.

Use the ditto master, "Which Print is Yours" for evaluation.

If time permits the children can look for footprints around the school. They might be interested in hearing a story of how tracks were used by hunters.

General Objective: The student will be aware of animal tracks in the environment.

Student Objective: The student will be able to identify the tracks of at least five local animals.

Conceptual Theme: Similarities and Differences

Materials:
- teacher information card, Making Plaster Casts of Animal Tracks
- shellac or plastic from a pressurized can
- plaster of Paris
- water
- paper clips
- tin can or plastic bowl
- salt or vinegar (optional)
- bits of food
- flour
- black construction paper
- track keys (see sources)

Teaching Suggestions: This card offers more depth to study of tracks. It can easily be accomplished as an individual or small group activity. It can be done at home as well as school. Try to have some of the references on hand before starting this activity.

After the student has obtained the animal tracks, he can make plaster casts using the directions given on the following information card.

If the bird feeder was made in connection with 29, the activity on bird tracks should be easy to accomplish.

Tracks tell many stories. They tell whether the animal was running or walking normally. The students may enjoy fantasizing about the animal that made the track. Try to find some stories on tracks for student reading.

MAKING PLASTER CASTS OF ANIMAL TRACKS

Here is how to preserve good tracks in mud or clay:

1. Clean track of loose particles of soil, twigs, leaves or other litter.
2. Spray track with shellac or plastic from pressurized can if available. If not, talcum powder sprinkled on track will keep the cast from retaining sand or mud.
3. Form 2-inch wide strip of cardboard or tin into a ring surrounding the track. Press firmly into ground to give support, but allow at least 1 inch to form edge of mold for plaster.
4. Mix about 2 cups of plaster of Paris in a tin can or plastic bowl, adding water slowly until it is about as thick as heavy cream. Pour carefully into mold until plaster is about to top. Allow plaster to harden at least 15 minutes before lifting out of track. If soil is damp, hardening may take longer.
5. Before plaster has hardened, add paper clip to serve as a hanging hook.
6. When cast is hardened, list cast out, remove ring, and clean the cast by scraping with a knife blade and washing.

TIPS:

1. Casts can be painted with poster paint or oil paints.
2. Salt added will speed up setting, vinegar will slow it down.

Student Card #36

General Objective: The student will be aware of protective coloration as an adaptation.

Student Objective: By careful observation the student will be able to point out at least 5 objects previously overlooked in a selected area.

Conceptual Theme: Change and Adaptation

Materials:
- paper
- crayons
- ditto of hidden animals (36-1), one for each student
- box of colored toothpicks (4 different colors including green)

Teaching Suggestions: Originate the activity with a walk. Tell the children they are to list the animals they see. When you return compile your list. Then talk about animals that blend into their surroundings. Several of the resources listed are excellent for illustration (see resources). The Ranger Rick articles have excellent pictures, as do the study prints. Remind the students that coloration is only one means of protection.

The students can choose one or several of the activities in the Do More section. The ditto of the hidden animals contains 13 animals. There are eleven different animals; the butterfly appears three times. Have the students color in the hidden animals and the background.

You can help the students visualize hidden animals for their own pictures by using some of the resources (study prints and filmstrips are good), or pictures from magazines. The students can use crayons, chalk, or cray-pas. The chalk and cray-pas allow for blending of colors.

Prepare for the toothpick hunt before class. For a class of 30, you need about 300 toothpicks. You need equal numbers of all colors. Before class-time scatter toothpicks in a grassy area. Tell the students to pretend they are birds and the toothpicks are insects. Allow them about five minutes for the hunt. Do not allow enough time for all the toothpicks to be found. Return to the room. Record the number of each color of toothpick found. Why are there differences? What color insect would you rather be? If time permits, repeat the activity in a different area (playground, sidewalk). What color is best for those areas?

Prepare a terrarium for the chameleon. (This animal is really Anolis but is commonly referred to as the American Chameleon.) Place green paper on the floor of the terrarium on one side, brown on the other. Observe the chameleon. Color change is one means of protection; another is speed. After your observation, return the chameleon to its native environment.

Conclude the activity by repeating the first walk. Compare the list of animals the class finds this time.

General Objective: The student will be aware of the importance of fossils as evidence of change.

Student Objective: Be means of a story, the student will illustrate an understanding of fossils and their importance.

Conceptual Theme: Change and Adaptation

Materials:
- clay
- coquina limestone or other sedimentary rock with fossil prints
- ditto of animal skeleton, one per student
- story, "The Making of a Horse" (37-1)
- information card, Fossil Huntin (38-3)

Teaching Suggestions: Fossils and fossilized remains give scientists a look at the life of past eras. Through the study of fossils, scientists are able to reconstruct the history of an area and of certain animals. Fossils are formed when some part of a plant or animal is preserved by nature. In some cases, only the print of the animal or plant remains. This the type of activity that the students are asked to do in the To Do activity. The leaf should leave behind a print. When this happens in nature, an animal or plant dies. Its remains are covered with dirt. Over a long period of time, the pressure turns the dirt into rock. The rock may contain a fossilized part of the animal, or may contain only the print. Many types of sedimentary rocks in your area may contain these prints.

Coquina limestone contains the prints of animals who were trapped in the limestone as it formed. It gets its name from the tiny animal, coquina. If time permits, take the children to the beach to see the coquinas. If you live in an area where coquina limestone is not abundant, river gravel will serve the same purpose. It too, contains the prints of trapped animals and plants.

Give the students a ditto of a skeleton. You can use the one on the cover or the information card 37-5. The animal on the cover is a penguin. Students should be able to detect a beak, wings and a tail. The feet also are a good clue. The animal on the information card is a cat. The students should be able to see four feet and a tail. They probably would not know from the skeleton that the animal had ears, or what color it was.

Sometimes scientists are lucky enough to find entire skeletons preserved. The story, "The Making of a Horse" illustrates how this information is used by the scientists. This particular story also emphasizes how the horse was able to change as its environment changed. This is especially important if the species is to survive. The following card investigates an animal that was not able to survive (38).

Student Card #37

Fossils are very abundant in this area, particularly in dredged areas. Read the information card, Fossil Huntin', for hints on how to go about hunting. Sharks' teeth are black and look like triangular teeth; you may find them whole or in parts. In order to recognize other fossils, you may need a field guide or the help of an interested older student. Many of the elementary schools in Brevard County have kits of fossils which were supplied by the Brevard Museum.

If interest is high, you might try reconstructing skeletons in class. ESS has an excellent unit, Bones, which give directions on assembling skeletons and supplementary activities. They also publish a Bone Picture Book which has more skeleton pictures (see resources).

Student Card #38

General Objective: The student will be aware of factors which can cause an cause an animal to become extinct.

Student Objective: By means of a story, the student will be able to hypothesize at least one reason dinosaurs became extinct.

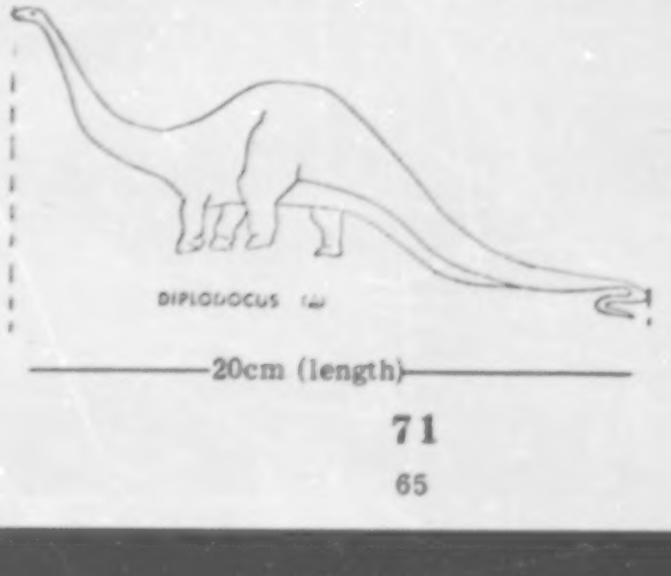
Conceptual Theme: Change and Adaptation

Materials:
- scale drawing of Diplodocus (38-1)
- yard stick or meter stick
- paper and pencil
- crayons

Teaching Suggestions: Dinosaurs are usually the objects of much interest in younger students. They are also an example of an animal that has become extinct. Most of our information about dinosaurs has come to us through fossils. The preceding card is an introduction to fossils.

There are several theories to account for the disappearance of dinosaurs. The most popular theory is that the environment changed while the dinosaurs did not. This change may have been sudden, as an ice sheet, or gradual. Some scientists theorize that dinosaurs disappeared because the eggs of reptiles are easy prey. Your students will probably mention these and many other reasons for the disappearance of dinosaurs. You may want the students to work singly or in groups in constructing their theories on the disappearance of dinosaurs and their stories.

An animal we know about through skeletal remains is the Diplodocus (DIP-lo-de-cus). You can compute the size of the dinosaur before class for younger students. The scale drawing of the Diplodocus can be duplicated for the class if you wish. Explain the meaning of the scale to older students. One centimeter on the drawing equals 80 centimeters, or one inch on the drawing equals 80 inches. Then measure the length of the dinosaur and compute his real length in centimeters. (80) times (measured length in cm.) = (actual length.) Also figure the height. This should help the students conceptualize the actual size of the Diplodocus.



length:20cm.x80
length = 1600cm or
16 meters

Student Card #38

Go outside to mark the size of the dinosaur using students. This will help them see how large this animal was in comparison to them. This would be a good time to talk about information we cannot get from skeletons. Do we know what color this animal was?

Read a story on the dinosaurs and discuss what the earth looked like in the days of the dinosaurs (see resources). What was the climate like? How did he protect himself from other animals? Did he have to? How did he hide? Color? Did he have protective coloration? Talk about some reasons dinosaurs did not survive.

Student Card #39

General Objective: The student will be aware of the different uses of seeds for food.

Student Objective: From a self-made list of foods, the student will be able to select those that are seeds and those that are parts of seeds.

Conceptual Theme: Similarities and Differences

Materials: corn flakes, flaked coconut, walnuts, cocoa bits
condensed milk,butter, sugar, (see recipe for exact amounts)
recipe card for Fine Cookies (39-1)
measuring cup, bowls, pan
heavy (oaktag) paper or wood pieces
collection of seeds that vary in color or shading
glue
bean or corn seeds
soil
egg cartons
construction paper
magazines
scissors

Teaching Suggestions: Display items for cookies at the start of the activity. After students have had an opportunity to look at the foods, proceed with making the cookies.

Measuring can be a good math correlation. Also figuring how to cut the bars to get the number needed is a good math project. Cafeteria people will probably be very willing to put cookies in the oven for you for the baking time needed.

Have the students bring selected pictures of sees they eat. You might also have on hand pictures of some of the less obvious ones like soybean products. Use the pictures for the bulletin board or a collage.

Many animals, particulary rodents eat seeds. Some of the more familiar ones include squirrels, mice, rats, gerbils, and many species of birds.

To make the mosiac picture, start with several colors of seeds. Coffee bean seeds, bird seed, corn are good to have on hand. Paper on which seeds are to be set should be heavily layered with something like Elmer's glue. Do not move the pictures until they are dry.

You can plant bean or corn seeds in egg cartons filled with soil. Egg shells also work well. Soak the seeds for several hours before planting. Save some of the soaked seeds for students to examine; plant the others.

Every other day, dig up a seed to see what has happened. The food in the seed is being used to nourish the young plant until it develops its own food-getting structure. The book, A Seed is a Plant would be excellent here (see resources).

The peanut is one of our most completely used plants, due largely to the efforts of George Washington Carver. This is an interesting story to read. Another seed that is widely used is the soybean. Ask your Department of Agriculture for more information.

General Objective: The student will understand that different animals have different food needs.

Student Objective: The student will be able to name at least two foods that one animal eats and show at least one way that animal is adapted for eating those foods.

Conceptual Theme: Similarities and Differences

Materials:
recipe for cookies (39-1)
cards cut from construction paper for animal recipes
recipe book
newsprint, crayons

Teaching Suggestions: Use a recipe to make something to eat. If the entire class participates, the recipe should be put on a poster. This can be used as a lesson in measuring and following directions. Show the students what a recipe is from the book.

After the initial recipe is finished, discuss how an animal recipe would be different. Take at least one animal with which the students are familiar and discuss the foods that animal likes. Make up a recipe for that animal's dish and put it on a card. Then discuss how this animal is adapted for finding and eating these foods. A large picture of the animal would help. Look at the animal's eyes, ears or sensory organs, feet and mouth. Show how the animal is adapted for those foods. Let the students do the same thing of an animal of their choice.

It may be necessary to do some research in order to make cards for some animals. The filmstrip listed will provide information on some animals (see resources). Many of the other cards in this packet discuss foods of different animals (see index). In order to play the mix and match game, put the recipe on one card and the animal's name on another. The students can add to them as they learn more about animals and what they eat.

Encourage the students to make cartoons and post them on the bulletin board.

Student Card #41

General Objective: The student will gain an understanding of food chains.

Student Objective: Given a set of pictures, the student will be able to order them into a food chain.

Conceptual Theme: Interaction and Interdependence

Materials:
- story, "Links of Life" (41-1)
- transparency of food chain drawing (41-3)
- ditto of plants and animals to be arranged in food chain, for evaluation (41-4)
- materials for posters
- materials for mobiles
- materials for puppets
- magazine pictures of foods
- glue, scissors

Teaching Suggestions: A food chain is the simplest way of tracing the energy transferred through food. All energy originates with the sun. Of all the living things on earth, only green plants have the ability to use this energy directly in the manufacture of food. Animals depend on this ability of plants for their food. Some animals eat plants directly; others eat animals that ate the plants.

Begin the activity by reading the card, Links of Life. This card introduces the concept of a food chain. After you have finished reading the card, use the transparency, Where Did Your Glass of Milk Come From? Trace the glass of milk back to its beginning. If necessary for understanding, repeat this process with other foods. Ask the students to do the same with foods they ate for breakfast. (A good opportunity to discuss nutrition.)

Have the students make posters or mobiles of their food chain. Talk about what would happen if one of the animals disappeared. What would happen if the plant disappeared?

Give each student the evaluation ditto or pictures of your own choosing. Have them cut the pictures out and arrange them, starting with the source of energy. The completed picture should show:

sun plant dragonfly frog snake hawk.

Some additional questions you may wish to talk about include:
What would happen if all the snakes were killed?
What happens to the hawk after it dies?

All of the questions in the Do More section can be answered in a puppet show. If your students are stumped at making up a script, try the one on S-44.

Student Card #42

General Objective: The student will be aware of the different niches in a food web.

Student Objective: Given the name of a plant or animal, the student will correctly identify it as a producer, consumer, or decomposer.

Conceptual Theme: Interaction and Interdependence

Materials:
- ditto of energy wheel and parts (42-1, 2), one for each student
- scissors
- paste
- construction paper
- marker
- roll of string
- crayons

Teaching Suggestions: This card explores the idea of niches, or roles, in nature.

The green plants are the producers. They alone have the ability to capture the energy of the sun and transform it into food. This process is called photosynthesis. All other living things rely on the producers for food. Animals may consume the plant directly. These animals are called herbivores or first-order consumers. Animals that eat other animals rather than the plant are called carnivores or second-order consumers. They can all be grouped in the class of consumers for class purposes. The third niche discussed is that of decomposers. Decomposers make possible the return of materials from dead organisms and waste materials. The decomposers break down the materials to the chemicals that the plants can use. This completes the cycle of energy or nutrient flow.

Before class, run off copies of the energy wheel and its parts on construction paper for the students. Have them cut out the pictures of the green plants. Talk about producers and what they do. Paste the picture of the green plant on the energy wheel in the correct place. Talk about the things that are necessary for the plant to grow and produce (sunlight, water, and nutrients). Who eats the plants? Find the picture of the consumer and cut it out. Talk about consumers. If you wish, you make the distinction between plant and animal eaters. Both kinds are shown here. Paste the picture of the consumers on the energy wheel. Ask the class to name other consumers. Finally, ask the students how dead plants and animals and waste materials are disposed of. This is the job of decomposers. Talk about the importance of that job. Cut out the picture of the decomposers. Paste it on the energy wheel. Talk about the completed wheel. Trace the flow of energy and materials on the wheel.

Talk about what happens if all the producers are destroyed. Do this for each niche.

This would be a good time to take a walk outside. Look for producers, consumers, and decomposers. Decomposers may be hard to find. You may be able to find mushrooms or toadstools. Many of the decomposers like bacteria, are too small to be seen with the naked eye. If you have not already done the activity on composting, this would be an excellent time for it, since the students can see decomposers at work (see index). If you have already done it, talk about the decay they observed.

Cut pieces of poster board, one for each student. Put the names of plants and animals you talked about during the walk on the pieces. You may need to include other plants and animals to have enough for each student. Have the students identify the role each plant or animal plays.

Student Card #43

General Objective: The student will understand the pattern of interaction in a food web.

Student Objective: Given a set of pictures, the student will connect the plants and animals into a food web.

Conceptual Theme: Interaction and Interdependence

Materials:
roll of string
construction paper
markers
evaluation ditto (43-1)

Teaching Suggestions: Food chains as we have talked about them rarely exist in nature. What does exist is a food web. Food webs show the interaction between food chains. They also show the interdependence between food chains. This can be illustrated by having one animal in the food web disappear. The normal balance of numbers is destroyed.

Begin the activity by having the students read the definition of a food web. Have them study the front of the card. Can they pick out the food chains? Hypothesize what would happen if one of the animals were killed. The animals below the animal in the food web will increase in number. The animals that depend on that animal for food will decrease in number. What happens when we kill snakes and other predators? This point is explored on another card, but the students should see that this allows many animals that compete with man for food to increase in number.

Predators are animals that kill other animals for food. They are explored in more depth on another card, 46. The point here is merely to have the students recognize their presence in a food web. Scavengers are animals that eat dead things. Scavengers, in spite of the important role they play, are often disliked by people. Have the students look for scavengers in their food web.

If the students did the preceding activity, you can use the name tags from the evaluation. If not, you will need to make a name tag for each student in the class. Put the name of a different plant and animal on each tag. Be sure to include the names of producers, consumers, and decomposers. Give one tag to each student. You can start anywhere, just pick a student at random. Give that student the end of a roll of string. Ask the question, "What eats this animal?" After the group has identified the animal that consumes the first, run the string from the first student to the second. Continue with this procedure until all the students have been worked into the web. You may need to change the question slightly for producers and decomposers by saying, "Who uses the energy from this animal?" To illustrate the interdependence of the animals in the web, ask, "Who will be affected if this animal is killed?" Have each student who is connected to the first drop the string. Every other living thing in the web is affected.

Give the students the evaluation ditto. Have them connect the living things in the web with arrows. Discuss the answers.

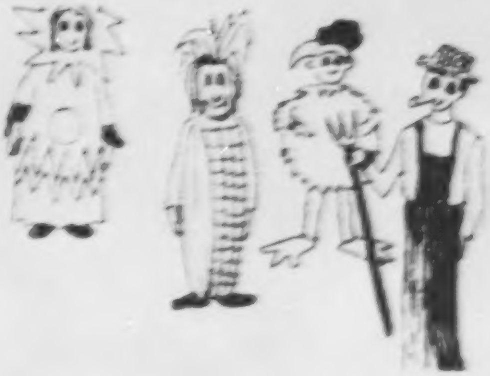
General Objective: The student will be aware of the relationships in a food chain.

Student Objective: From characters presented in a play, the student will be able to identify the producer, first and second order consumer.

Conceptual Theme: Interaction and Interdependence

Materials:
materials for props
tempra paint
brushes
script (44-1)

Teaching Suggestions: This card should be used in conjunction with the one on food chains (41). These cards will give the students the background information needed to understand the play. The student can write their own script, of course, or modify it as they wish. They can do this as a play or as the puppet show suggested on card #42.



General Objective: The student will understand the term "food pyramid."

Student Objective: The student will be able to construct a food pyramid of at least three levels.

Conceptual Theme: Interaction and Interdependence

Materials:
- information card, The Cide List (51-5)
- transparency of pyramid
- newsprint
- construction paper
- crayons
- glue
- scissors

Teaching Suggestions: This card explores the idea of a food pyramid. If you have younger students, you may find that this concept is too advanced for them.

A food pyramid is a way of picturing the relationships of the producers, first and second order consumers in terms of energy and the mass it supports. The central idea is that the further one travels up a food pyramid, the less mass can be supported. The pyramid is shaped this way because each time something is eaten, energy is lost. It takes lots of wheat (producers) to feed the mice (consumers). Some of the energy from the wheat is used by the mice for daily acitivies, and only part of it is stored in the mice. The hawk will need to eat lots of mice to get the energy he needs. Each transfer will support fewer (or a smaller mass of) consumers.

The wheat produces food for everything else in the pyramid. The mice consume food from the plants. They are called first-order consumers. The hawk, who eats the mice, is a seond-order consumer.

The students are asked to construct a food pyramid using the pelican as the final consumer. Information which should help them is given on the information card, The Cide List (see index). The pelican's primary food is fish. Each pelican eats lots of fish. The fish feed on smaller fish or on plants. Thus, their food pyramid can contain three or four levels.

The concept of a food pyramid becomes very important when talking about pesticides. It explains how DDT and other long lived pesticides become concentrated in the bodies of higher order consumers like pelicans and eagles. They eat many large fish which ate many small fish, which ate many plants, which contained DDT. The Cide List (see index) diagrams this relationship.

For an evaluation, have the students put themselves at the top of the pyramid. The second level should be some meat they like, for instance beef. The bottom level then, should be the food the cow eats, grass or corn.

Student Card #46

General Objective: The student will be aware of the role played by predators in a food web.

Student Objective: The student will be able to state, in a letter, at least one reason why predators should not be indiscriminately killed.

Conceptual Theme: Interaction and Interdependence

Materials:
story, "Wolves are Necessary" (46-1)
pictures of predators
paper and pencil

Teaching Suggestions: Predators have long been the object of indiscriminate killing. They have been trapped, poisoned, and shot from airplanes. Predators, like all animals, play an important part in the balance of nature. Predators always take prey in proportion to the numbers available. This point is further explored in the story, "Wolves are Necessary." The story should be read by the entire class. Discuss the questions at the end of the story. There is also an activity card on owls (see index).

There are some states that have paid bounties for the hides of predatory animals. In doing this, they were focusing only on the harm the animal did, i.e., coyotes killing the farmer's sheep. They were ignoring the good the animal did. In the case of the coyote, it also ate jackrabbits that destroyed the farmer's crops. There has been recent legislation to protect some of the previously hunted animals. You can find more information in some issues of Audubon.

In order for this card to succeed, the students will need to understand the concept of a food web. The simulation of the web where one animal is eliminated from the web would be excellent to repeat here. To make the point more vivid you might construct a local food web and then eliminate the predator. Ask the students what will happen to the other animals in the web.

Have the students try to name as many predators as they can. The ones they will be most familiar with include snakes, alligators, raccoons. Have them try to construct a food chain using one of these predators.

For the mix and match game, you can use pictures if you have them, or simply write the names of the predator and their prey on cards.

Student Card #47

General Objective: The student will understand the importance of owls.

Student Objective: The student will be able to state, in a paragraph, at least three reasons owls are important.

Conceptual Theme: Interaction and Interdependence

Materials:
- student information card, The Owl's Story (47-1)
- smooth rocks, 2"-3" in diameter (see teaching suggestions)
- shellac or fixative
- paint - tempra or acrylic
- information card, Stone Critters (47-5)

Teaching Suggestions: you can introduce this activity either with the story about owls or the making of rock critters. After the introduction of the activity, encourage those students who are interested to do some reading about owls.

Very few owls are daylight hunters; most hunt at dusk or at night. They are specially equipped for this task by their eyes and ears. Their eyes are very large and capable of rapid and sharp focusing at various distances. Their eyes are directed forward and immovably fixed in bony sockets. Owls must turn their head toward an object to see it. While we can only rotate our head 180° (half-circle), an owl is capable of turning its head through an arc of 270°! Extra neck vertebrae allow this flexibility. Owls can expand and contract the size of the pupil; hence, they can see well in bright sunlight. Owls have exceptionally keen hearing. Their large ears are directed forward; one ear is directed downward, the other upward. This enables owls to locate sounds with amazing accuracy; they can hunt in complete darkness.

Owls and hawks prey mainly on rodents. They swallow their prey whole. In their stomach, the indigestable parts are rolled into a pellet. These pellets are regurgitated a few hours after feeding.

Owls help maintain the balance of nature in an area. When prey is scarce, many young owls do not survive.

The Audubon article contains some lovely black and white sketches of different owls. You might wish to use this in conjunction with the story.

To make rock critters, consult the information card, Stone Critters. Smooth rocks can be obtained from a garden supply store.

The Ranger Rick articles are excellent references for the students; the Audubon reprints listed make good background reading for the teacher.

Student Card #48

General Objective: The student will be aware of the development of an amphibian.

Student Objective: The student will be able to draw the life cycle of one amphibian.

Conceptual Theme: Change and Adaptation

Materials: teacher information card, Raising Frogs and Toads
information card, Life Cycle of a Bullfrog (48-1)
frog or toad eggs
pond water
large glass containers
algae
paper and pencil

Teaching Suggestions: The life cycle of an amphibian is the perfect example of adaptation to a changing environment. The amphibian begins life in a water environment. It is adapted to this environment by gills and a swimming body. As the amphibian develops, its body begins developing adaptations to the land environment. Finally it has developed legs and lungs. As an adult, it mates and lays its eggs in the water environment. Thus, the cycle is completed. The teacher information card gives the information you will need to complete this card, including suggestions for collecting and caring for eggs. If you are not able to collect eggs locally, you can order them from Carolina Biological Supply Co., Burlington, North Carolina 27215, or any other biological supply house.

The best way to originate the activity is with the collection of eggs in the spring. Be sure to read the Checklist for Fieldtrips before going (see index). Freshwater Encounter (see resources) has some additional activities you may wish to try at the same time. If you are unable to obtain eggs locally, then originate the activity by showing the eggs to the students. Be sure to allow sufficient time for observation and hypothesizing. This activity will be more meaningful to the students if you allow an air of mystery to remain. Let them wonder what each day will bring.

This activity can best be accomplished by allowing a short period of observation each day. At this time the students can make their entries in their logs. Show the students how to set up a log and record observations. They should include the data, observations, and inferences. Observations are strictly those things that can be sensed-seen, smelled, heard, felt. Inferences can include what they think is happening: i.e., tadpoles are developing in the eggs. They should record their observations daily. Inferences may be discussed by the class periodically.

The information card, Life Cycle of a Bullfrog, can be used to make a transparency for the class at the end of the activity.

Student Card #48

Don't miss an opportunity to tie this card to the activities on estuaries--it's a natural.

The Ranger Rick articles listed are excellent reading for the students. They contain a wealth of information on frogs and toads. They will help in answering the questions in the Do More section. The ESS Unit listed is good for teacher background and as a source of additional activities.

Teacher Information Card

Raising Frogs and Toads

Frog or toad eggs can be found in great abundance in the spring, or they can be ordered from a biological supply house.

Frog eggs are laid in clumps and toad eggs are laid in strings. The eggs can be kept in the same water in which they were gathered and placed in an aquarium. Care should be taken not to overcrowd.

The eggs will hatch within about four days after they are laid. If a tadpole is well fed, two hind legs will begin to appear at the base of the tail in about six weeks.

To be absolutely sure of having some tadpoles change into frogs, it is a good idea to maintain two or three containers with only two tadpoles each, changing the water and feeding the tadpoles regularly. Since chlorine and copper kill tadpoles, it is best to use pond water. Collect it when you collect the eggs. Bottled spring water (not distilled water) may be used.

The temperature of the water should be kept below 75° F. At colder temperatures, the eggs and tadpoles develop more slowly. Assign someone to record the temperture of the water each morning and afternoon.

The tadpoles' natural food is algae. The yellowish-green or grass-green strands growing on leaves and sticks or floating on the surface of most ponds are ideal and can be found in large quantity in the spring.

Empty the algae and water from the pond into an aquarium containing soil and water. A fluorescent light will do for a light source. Keep the water level in the algae farm constant, by adding a half-cup of pond water every few days.

Tadpoles are extremely voracious and can eat their weight in algae every day or two.

The principal advantage of having algae as a food is that it purifies the water by utilizing many of the waste products of the tadpole. It also adds oxygen to the water.

If the tadpoles' water becomes milky or cloudy or smells rotten, it should be changed that day. The tadpoles should be caught in a strainer or cloth and gently tapped back into the empty container. Fresh water should then be added.

An excellent booklet, Teachers Guide For Eggs And Tadpoles by Elementary Science Study gives a detailed background and teaching suggestions for elementary. See the cost package in the appendix for ordering information.

Reference:

Eggs and Tadpoles, Elementary Science Study. Webster Division of McGraw-Hill.

Student Card #49

General Objective: The student will be aware of the importance of estuaries.

Student Objective: The student will be able to state, in a letter, at least three reasons we need estuaries.

Conceptual Theme: Interaction and Interdependence

Materials:
- student information card, Estuaries (49-1)
- menu from a local restaurant serving seafood
- map of nearest coastal area
- red crayons

Teaching Suggestions: This card attempts to illustrate the importance of estuaries. Estuaries are semi-enclosed coastal water bodies which have free access to the sea. The water in an estuary is diluted from that of the open sea by freshwater runoff. The estuary is considered by some to be the most productive system in the biosphere. The tides and freshwater runoff result in a constant mixing of the nutrients on the floor of the estuary. The nutrients are constantly replenished by sedimentation and decay, giving the estuary its characteristic odor. The water in the estuary is brackish; a mixture of salt and fresh. The further one moves toward the freshwater source, the more the salinity decreases. The types of life found in an estuary vary by location as the salinity changes. Many marine species spend some part of their life cycle in the estuary. For further information, read the teacher information card that follows.

Since few students will know what an estuary is, they should begin the activity by reading the information card on estuaries. Discuss generally the types of animals that might be found in an estuary and where estuaries are. Try to secure a menu or place mat from a local restaurant that serves seafood. Have the students pick out the items that might have come from an estuary. With older students, you might try making a list of all the jobs or industries that depend upon estuaries. You might be able to visit one of the industries to see how they depend on the estuary.

Obtain a map of the nearest coastal area. Locate and mark in red the estuaries. Generally speaking, the estuarine system in Brevard County consists of the Indian and Banana Rivers, Sykes Creek, and the Sebastian River. Much of this system is lagoon and swamp areas. The only outlets to the sea are at Port Canaveral (artificial outlet) and Sebastian Inlet.

The main threats to our estuarine system come from sewage discharge and agricultural runoff. Urban development also threatens to fill many of the marshy areas for use as homes. At least five sewage treatment plants discharge their partially-treated effluent into Sykes Creek alone.

Student Card #49

This would be a good time to visit an estuary in your area. If you go, take a collecting net along. Look for signs of life. Talk about the odor. Look also for things that are endangering the estuary. If you cannot go to an estuary, have the entire class share the Ranger Rick article listed in the resources.

Conclude the activity by having the students write a letter to an adult. They may write to someone in their family, or if they wish, a government official. Be sure they state why estuaries are important. The might also want to ask what is being done to protect our estuaries.

Student Card #49

ESTUARIES AND LAGOONS

Estuaries and lagoons have shallow brackish water resulting from the mixing of fresh water and salt water in regions where rivers meet the sea. An estuary is defined as the wide mouth of a river where the tide meets the river's current, while a lagoon is salty water parallel to, and separated from, the sea by a barrier beach. During high tides, water enters the estuary or lagoon from the sea, often rushing under the fresher water which floats on top of the incoming sea water. The outgoing tide reverses this process carrying brackish water back out to sea.

The waters of estuaries and lagoons have many kinds of marine life. One reason for this is the mixing of nutrients carried from the land by rivers and streams with sea water, resulting in the growth-promoting environment known as brackish water. These waters are the sheltered nurseries for many marine fish of great value in sport and commercial fisheries. The basis of this productivity is marine algae, both free-floating and attached. Oysters and clams grow rapidly on the microscopic plant plankton. Algae-eating fish, such as mullet, subsist upon sea lettuce and other attached plants. Even the sea cow, a marine mammal, is completely dependent upon marine vegetation as a source of food.

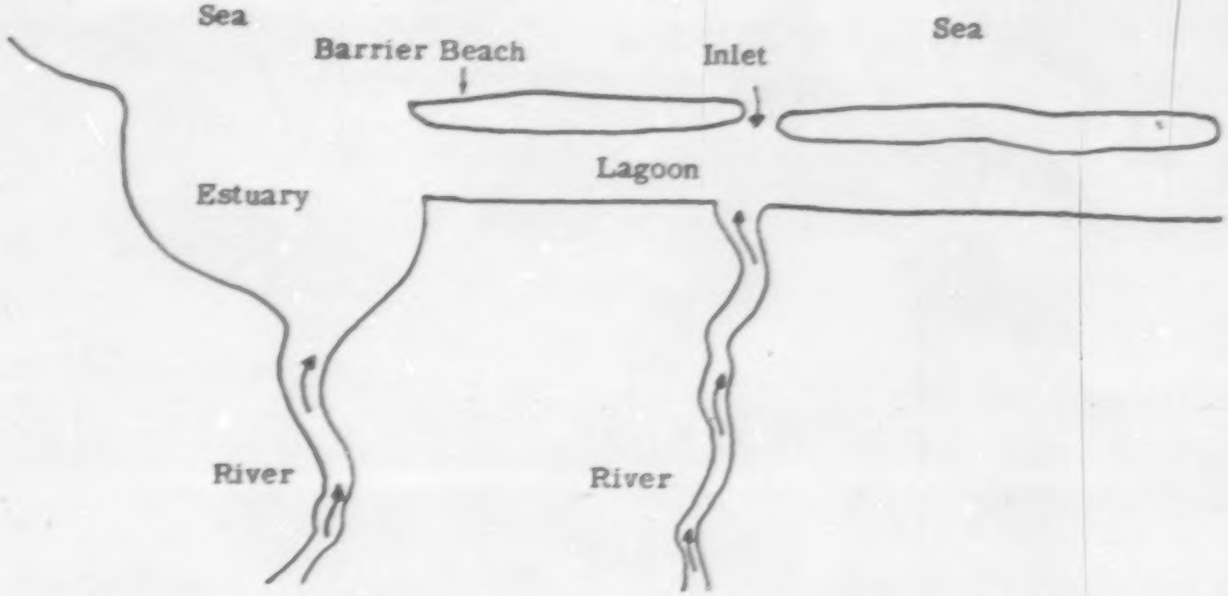
The predators (animals that feed upon other animals) of the estuaries and lagoons include sea trout, pelicans, ospreys, sting rays and sharks. These animals live on small fish and a variety of shell fish, including shrimp. The estuaries provide quiet shallow waters for the breeding and young of shrimp, sea trout, mullet, snook, and even sea horses.

The waters also produce food for millions of migrating waterbirds. These include scaup, grebe, mergansers, coots and cormorants. Most of these appear in the lagoons and estuaries during the fall, winter, and spring--summers are spent breeding in the wet prairies and tundra of Canada.

Information adapted from Teachers Curriculum Guide for Field Ecology,
Brevard County Center for Environmental Learning, 1971.

Student Card #49

In Brevard County our lagoons are the Banana and Indian Rivers.



SALT MARSHES

This plant and animal association is typically grassy with few, if any, trees or shrubs. These grassy areas form a coastal margin between the land and sea and are washed alternately by nutrient-rich runoff from the land and trace-element rich tidal waters. The salt marshes are ideally suited for the growth of algae and plant life. This provides a good food supply for many animals. Grasses are often the dominant and only plants. In Brevard County this association can be seen in the Merritt Island Wildlife Refuge and some other limited areas near the sea.

Characteristic of this habitat are many species of aquatic birds, especially the unique clapper rail. Reptiles adapted to this salty environment are Clark's water snake, a turtle called the diamond-backed terrapin and alligators. Mammals found here include the round tailed muskrat and the marsh rabbit. Raccoons may not live in these areas but they hunt for food in them. Most of the Brevard salt marshes have been diked in order to isolate them from their supply of salt water for mosquito control purposes.

Student Card #50

General Objective: The student will investigate life in a vacant lot.

Student Objective: The student will be able to show, by means of a mural, the life observed in a vacant lot.

Conceptual Theme: Interaction and Interdependence

Materials: information card, Life in a Vacant Lot (50-1)
insect book
bird book
wild flower book
see resources
large paper on which to do murals
compass
digging tools
plastic bags
note pads

Teaching Suggestions: Be sure to read the checklist for field trips (see index) before taking the entire class. If this is done as a small group activity, children need to be cautioned about any dangers. See what precautions your school takes first.

Survey your surroundings for a vacant area suitable for investigation. If you live on the beach, you may want to explore an undisturbed area of it. There are several nature preserves in Brevard County as well. Any vacant lot without a lot of traffic will do. A vacant area should provide more opportunities for observation of a natural system.

Read the activity card, Life in a Vacant Lot before going. The first observations should be made from a distance. The type of plants will depend on the location and the length of time the area has been left undisturbed. Generally, an area will change (succession takes place) until the dominant plant for that area takes over (climax). What evidence do you see that the area is still changing? How long do you think the area has been left undisturbed?

After a period of initial long-distance observation, go into the area. Look for evidence of animals. Ask the students to look for the animals, or some evidence of the animal. Examples are bird feathers, ant hills, etc. How many different animals could you find evidence of? Look below the surface of the soil.

Encourage the students to look at the interaction between the animals and the soil. What would happen to the soil without all the animals that make their home there? How do these animals aid the plants? How do the plants aid the animals?

A simple method of mapping is to use the students pace (measured before hand) as a unit. Have them step off all distances and record them. You can transform these to feet in the classroom. Carry along a compass for directions.

The food-web activity outlined earlier (see index) can be used here. You can modify it by using the animals the students found in the lot rather than names you supply.

General Objective: The student will understand some of the dangers involved in using pesticides.

Student Objective: The student will be able to state, in a paragraph, at least three reasons that pesticides should be used with care.

Conceptual Theme: Interaction and Interdependence

Materials:
information card, The House That Jack Built (51-1)
information card, The Cide List (51-5)
information card, Florida's Endangered Dozen (53-1)
see garlic pesticide information card for materials list
materials for posters
teacher information card, Pesticides

Teaching Suggestions: This card is designed to make the students aware of some of the effects that chemical pesticides have upon wildlife. It also gives them an opportunity to investigate alternative solutions to persistent pesticides. The following teacher information card on pesticides is included to give you a brief background on the development of pesticides, the problems associated with their use, and the role of the federal government in regulating them.

Begin by having the students read this version of The House That Jack Built. Discuss what happened to the animals and people in the story. The Ranger Rick reprint listed in the resources has a factual story about what actually happened in Borneo. It is a classic example of how DDT destroyed more than the pest.

Follow up the story by having the students take a survey of the pesticides used at their homes. They should be sure to list the chemicals in the pesticide. They can compare them to the list on deadly ones. Before they undertake this activity, they should clear this with their parents. Remind them that pesticides are deadly. All pesticides should be labeled with directions for application and storage.

The Cide List can be used for class reading. You can reproduce the list of harmful pesticides for the students to take home. The Cide List illustrates how pesticides invade a whole food chain. The idea of the concentration of pesticide in the bodies of animals at the end of the food chain will be especially clear if the students have done the card on food pyramids (see index). The brown pelican is further discussed on the information card, Florida's Endangered Dozen.

The Do More section gives the students the opportunity to try out some of the natural controls suggested in The Cide List. One of the easiest to set up and try is the garlic pesticide spray.

Student Card #51

The information card on garlic pesticides gives the directions for mixing that pesticide, as well as for growing garlic. Research has shown that organically grown garlic produces better results than garlic which has been artifically fertilized. The reason appears to be that humus aids in the production of "allicin" (al-il-sin), the active ingredient in garlic. Allicin is a mixture of many things, mostly allyl sulfides. These allyl sulfides are produced by enzymes working in the garlic bulb; the enzymes depend on absorbable sulfur. The sulfur is produced in the soil by micro-organisms, mostly certain tiny fungi that grow only with lots of humus present.

For more information on garlic pesticides, write:

Henry Doubleday Research Association
20 Convent Lane
Bocking, Braintree
Essex, England

Here are the researched insect kills for garlic use, taken from Organic Farming, September, 1972.

87% in screwworm infestations
83% cockchofer larvae (a problem in New Zealand)
91% mole crickets
82% gray field slug
98% cabbage white and ermine moth caterpillars
95% cabbage root fly and carrot fly
95% onion fly larvae

It may be necessary for you to help the children design an experiment, once the spray is made. They need to designate areas for experimental spraying and control. They will then need to keep records of insects found in each area. It would be wise to separate the two areas by a neutral stretch of land. Be sure to see the students select the same type of growth for each area.

Other natural controls are discussed on the card, The Cide List. You may want to have students try them also.

Student Card #51

INFORMATION CARD

Garlic Pesticide

To make a garlic spray: Use 3 oz. chopped garlic bulbs (can use bought garlic bulbs, though organically grown ones are much better). Let them soak in two teaspoonfuls (50cc) of mineral oil for 24 hours. Add 1 pint of water in which 1/4 oz. of oil-based soap (ex. Palmolive) has been dissolved. Stir well. Strain the liquid through fine gauze or store it in a glass container (it reacts with metal).

Try it against the worst insect pests you know, starting with a dilution of 1 part to 20 parts of water, then going down to 1 part to 100 so you use as little as possible.

In past research, it seemed that garlic worked well as a pesticide sometimes but sometimes not. Now it seems that maybe the most important thing about the garlic spray is that it should be made from garlic grown in humus rich mixture instead of chemical fertilizers which were sometimes used.

How to grow your own garlic: Buy bulbs from a grove or health food shop. Split them into their cloves and plant the cloves with the pointed noses just below the surface. Keep them 6 inches apart and a foot between the rows in well-composted soil in full sun. Lift them out when the foliage dies and store in dry area until ready for use.

Garlic will not harm animals or people. In fact, there are some indications that it may improve the health of the body and is helpful in repelling fleas and mosquitoes as well.

Resources:

Hills, Lawrence D. Organic Farming, Sept. 1972.

TEACHER INFORMATION CARD

Pesticides

In the United States, we have been using various chemicals for many years to control insect pests. Among the earliest insecticides were sulfurs and compounds containing arsenic. Light oils were often used to control mosquitoes. Later, man-made organic compounds (organic means they contain carbon) were developed. Some of these kill insects long after they are applied. Chemicals, called herbicides, were developed to control undesirable plant growth, and others, fungicides, to protect plants from diseases. Chemicals are also used to control pests such as rodents. By now, thousands of such pesticides in liquid, granule and powder form have been used in the United States. Many people probably use too much pesticide on the theory that "if a little is good, a lot is better."

We know, of course, that these chemicals are beneficial. They have enabled us to increase food production greatly, and they have controlled such killing diseases as malaria and encephalitis. We know now, however, that some of these compounds may also seriously damage our environment.

Some of the newer pesticides are called persistent compounds because they do not break down readily in nature's recycling system. This is especially true of the chlorinated hydrocarbons such as DDT. They persist in the environment and eventually accumulate in the tissues of birds, fish, wildlife and even man. As larger species feed on smaller ones, more and more chemicals are concentrated in their tissues. Some predatory birds, fish, and animals may accumulate levels several thousand times the concentration found in the water or air or plants around them because they receive all the chemicals stored by all the animals in their "food chain." (This is explained for the students in *The Cide List.*)

Man is at the top of this food chain, and the average American now carries about eight parts per million of DDT in his fatty tissues. We do not know if this amount is harmful to humans. However, we have known for some years that DDT kills fish and there is evidence that it threatens other desirable wildlife species.

For example, certain bird species now produce fewer offspring, probably because of pesticide accumulations in their bodies. Pesticides may cause birds' eggs to have thin shells which crush before babies can be hatched. The brown pelican and the peregrine falcon are among birds regarded as "endangered species" because so few young birds are now being hatched either because of pesticide residues or other environmental factors.

A large part of the pesticides we use finally reaches the ocean. It is estimated that about one-fourth of the world's entire production of DDT may be in the sea, and pesticide residues are found in almost all ocean fish. Some scientists believe that pesticide contamination is the reason that fewer shrimp, crabs and oysters now are found in certain areas.

Some of the newest pesticides are less persistent than others, but they are more poisonous. Some have caused accidental kills of both wildlife and humans. Of course, almost any pesticide can be dangerous if it is carelessly or improperly used. In fact, misuse of pesticides causes about 200 human deaths every year and thousands of cases of severe illness.

The Federal government began regulating pesticides in 1947, under the Federal Insecticide, Fungicide, and Rodenticide Act. That law was greatly improved by the Federal Environmental Pesticide Control Act of 1972. EPA now has the major responsibility to control pesticides under those laws and under a provision of the Federal Food, Drug and Cosmetic Act. Here's how:

- All pesticides and factories where they are manufactured must be registered by EPA.
- To be registered, a pesticide must be safe. When used properly, it must not have unreasonable adverse effects on the environment. It must be properly labeled, with clear directions for use. It must serve its intended purpose--that is, it must do what the label says it will do.
- If a pesticide meets EPA standards, EPA registers it and classifies it for "general use," for "restricted use," or both.
- A "general use" pesticide is one that will not cause unreasonable adverse effects on the environment.
- A "restricted use" pesticide is one that may adversely affect the environment or injure the person applying it. A "restricted use" pesticide may be used only by or under the direct supervision of a certified applicator. People trained to handle these dangerous pesticides will be certified by EPA, or by a State if its certification program meets EPA requirements.
- EPA continually studies the effects of approved pesticides to make sure they continue to meet all requirements. If problems develop, EPA is empowered to act. EPA can cancel a registered pesticide that damages the environment. In emergencies, EPA can immediately suspend the use of a registered pesticide to prevent an imminent hazard to people, to the environment or to an endangered animal species. EPA also has authority to seize and confiscate registered pesticides that are adulterated or misbranded, or that damage the environment. EPA can also seize and confiscate unregistered pesticides.

- EPA also sets standards to limit the amount of pesticide residues that can be in our food and in feed crops for animals. These safety limits--or "tolerances," as they are called--protect our health, and the health of animals, and are set well below the point at which pesticide residues might be harmful. The Food and Drug Administration, part of the Department of Health, Education and Welfare, enforces the tolerances and may seize any food that contains too much pesticides.
- Anyone violating the pesticide control laws may be fined up to $25,000, be sentenced to one year in prison, or both.
- EPA also monitors pesticides in the environment--in the air, soil, water, plants, and in man and animals. EPA also conducts research on the effects of pesticides on the environment, including humans.

Pest control is necessary if we are to have the food we need and to protect our health. Thus some chemicals will probably always be used to fight pests. However, a strange thing is happening. More and more insects are becoming immune to chemicals that once killed them. In some places, mosquitoes that carry malaria are increasing and are even more difficult to destroy than before.

Scientists, in EPA and throughout the world, are therefore seeking other methods of pest control than the use of chemicals. It is known, for instance, that some pests that attack crops and livestock can be partly controlled by their natural enemies, called predators and parasites. Some plant varieties resist insect and disease damage better than others. Planting different crops at different times can also reduce pest infestations.

Scientists have also been able to sterilize some male insects by atomic radiation and thus prevent massive reproduction of those insects. Sound ultraviolet light can also be used to trap and kill insects. And research is being done on the use of disease to destroy some insects by using viruses and bacteria to kill them. Research is also being done on the use of hormones to stop insect growth.

Eventually, by combining many methods into an integrated attack on pests, science hopes to sharply reduce the need for widespread use of chemical pesticides. Meanwhile, EPA seeks to make sure that the chemical pesticides we use are safe and will not endanger the environment.

Taken from Your World, My World.
Washington, D.C. :USEPA, 1973

General Objective: The student will be aware of territorial behavior in animals.

Student Objective: The student will be able to discuss at least one personal need that is territorial in nature.

Conceptual Theme: Similarities and Differences (Patterns)

Materials:
- magazine pictures
- scissors
- glue
- construction paper
- information card, A Territorial Animal (52-1)
- information card, A Different Language (14-1)

Teaching Suggestions: Introduce this activity by reading the card, A Territorial Animal. Discuss the behavior of the chickaree squirrel. What things does he do that might be considered territorial? At the same time, you might wish to have students review the card, A Different Language. How many different ways are mentioned in the card for expressing territorial behavior?

Have the students talk about their own feelings about their possessions. Do they consider one room in their house as being their territory? What other things do they have that they do not wish to share? Have the students look for pictures of things that they consider their territory. Use them to make collages.

Have the students observe people and animals in their neighborhood for examples of territorial behavior. Older students may want to try keeping a record of the animal, the type of behavior observed, and the thing being protected as territory. This type of behavior is readily observable in many animals such as blue jays, mocking birds, and some cats and dogs.

For the "What Things Bug You the Most" party, have each child put one thing that bugs them on a piece of paper. Put all the papers into a box. Then draw out each one and read it. Discuss how each is a territorial feeling. Examples might be, "When my little sister messes up my room."

Student Card #53

General Objective: The student will understand the significance of an endangered species.

Student Objective: The student will be able to identify one endangered animal, give at least one reason for danger to the animal's survival, and suggest at least one way that man can aid the animal.

Conceptual Theme: Change and Adaptation

Materials: information card, Florida's Endangered Dozen (53-1 through 16)
articles on endangered animals
see decoupage directions for list

Teaching Suggestions: This card was originally written for students in Florida. If you live in another state, supplement this information with information supplied by the Department of Interior or your state agency. If you cannot get enough supplemental information, you can simply choose those Florida animals that have national significance: bald eagle, brown pelican, and any others that may be familiar to your students.

Originate the activity by having the students read about at least one endangered animal. If you have older students, you may wish to divide them into groups and have each group research and report on one animal.

Discuss what the influence of predators on the endangered list has on the environment, and the food chain. Predators take prey in proportion to the number available; they help maintain nature's balance. Consult the card on predators. Discuss what the predators do when land developers plow up the land to build shopping centers and housing developments. Have the students discuss what illegal hunting does to endangered animals.

The idea of a food pyramid was introduced on an earlier card (see index). When an animal near the top of the pyramid is endangered, its prey increase in number and become a problem, out-eating their food source.

The scrapbooks can be a year-long project. While you are reading, be looking for pictures of endangered animals. Many advertisements contain usable pictures. If you cannot find pictures this way, look for stationary or greeting cards that may be suitable (see references). Directions for decoupage are given below.

Decoupage - The Easy Way

Materials:
- pictures of endangered animals
- wood, about 2" larger than the picture
- wood stain (optional)
- fixative
- glue
- brayer or rolling pin
- varnish or shellac diluted with alcohol
- paint brush
- fine sandpaper

Directions:

1. Prepare the wood. Start by sanding. You can then burn, stain or paint the wood.

2. Prepare the print. Spray it with a fixative or sealer to prevent bleeding and to give the print added strength. Tear, cut or burn the edges of the print.

3. Glue the prepared print onto the finished wood with Elmer's glue. Brush the glue on the back of the print. Use a rolling pin or brayer to help remove bubbles.

4. Varnish after glue has dried. Use a clear satin finish varnish. It will take quite a few coats. Let dry between coats. You may put the varnish on with a brush or use cheesecloth. If time is short, you can use shellac diluted with a little alcohol. The alcohol will cut down the drying time.

REFERENCES

REFERENCES

This section is designed to aid the teacher in enriching the concepts presented in the activity cards. The materials listed in this section have been suggested by teachers who have used the cards. While they should be helpful, they are not essential to the success of the program. References which you might want to consider purchasing are starred (*) the first time they appear. This is not presented as an exhaustive list; we hope to update it as more information is received.

RESOURCES BY CARD

STUDENT CARD #1

Look Around You. Scholastic Earth Corps, Environmental Awareness Series, Book 1, 1972. $2.35. Series of environmental awareness activities.

STUDENT CARD #2

Look Around You. Scholastic Earth Corps, Environmental Awareness Series, Book 1, 1972. $2.35. Series of environmental awareness activities.

STUDENT CARD #3

*Your Skin and Mine. Showers, Paul. New York: Thomas Y. Crowell, 1965. Primary. Let's Read and Find Out Series. $3.50.

The True Book of Your Body and You. Hinshaw, Alice. Chicago: The Children's Press, 1959.Primary level book. $3.00.

The House You Live In. Bloomfield, New York: Schering Corporation, 1972. Booklet about your skin. Free on request.

Teacher's Guide to Changes. Elementary Science Study. New York: Webster Division of McGraw-Hill. $2.73. Further suggestions for studying a variety of changes.

STUDENT CARD #4

Teacher's Guide to Changes. Ordering information given under student card #3.

"Fingerprint Owls and Other Fantasies," Ranger Rick Nature Magazine, Jan. 1975. Illustrations of fingerprint pictures.

STUDENT CARD #6

Textures. (The Art of Seeing Series) 10 min. Col ACI Films, Inc. 35 West St., N.Y., N.Y. 10036. Filmstrip on textures.

*My Five Senses. Aliki. New York: Thomas Y. Crowell, 1962. Primary Level. Let's Read and Find Out Series. $3.50.

Discovering Texture. 17 min. Color. New Jersey State Museum Cultural Center., West State Street, Trenton, N.J. 08725. Free upon request.

*Find Out By Touching. Showers, Paul. New York: Thomas Y. Crowell, 1961. $3.75. Excellent introduction to textures.

STUDENT CARD #7

My Five Senses. Aliki. New York: Thomas Y. Crowell, 1962. Primary Level. Let's Read and Find Out Series. $3.50.

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*The True Book of Sounds We Hear. Podendorf, Illa. Chicago: Children's Press, 1955. $3.00.

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All the Sounds We Hear. Nelson, Lee. Austin: Steck-Vaughn Co., 1960. $2.50.

*Your World, My World. Washington: US Printing Office, 1972. ($1.50) Discusses a number of pollution problems and steps being taken to combat them. Emphasizes role of the EPA. Teacher resource.

Familiar Sounds. Niles, Illinois: Developmental Learning Materials, 1972. $9.75. Tape of 50 familiar sounds with picture cards for students.

STUDENT CARD #9

1971 EQ Index, Washington: National Wildlife, 1971. Single prints free.

Your World, My World. Ordering information given under card #8.

STUDENT CARD #10

Inch by Inch. Lionni, Leo. New York: Astor Honor, Inc. 1960. $3.95. Introduction to measurement using the inchworm.

STUDENT CARD #11

Happiness Is. Shulz, Charles. New York: Litho. $2.00.

All Kinds of Feelings. Kindle, S. F. Englewood Cliff, New Jersey: Scholastic Magazine. Filmstrip with record. $2.00.

"Organic Gardening," Ranger Rick's Nature Magazine, May/June 1973. Discusses natural pesticides.

STUDENT CARD #14

"Ants," Ranger Rick's Nature Magazine, April 1974. Shows different types of ants, ant nest, roles.

"Army Ants," Ranger Rick's Nature Magazine, Nov. 1974. Article, drawings about army ants.

"Building An Ant Nest." Ranger Rick's Nature Magazine, July 1969, p. 36.

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STUDENT CARD #15

The House You Live In. Bloomfield, New York: Schering Corporation, 1972. Booklet about your skin. Free on request.

"What's Happening at Your House?" Ranger Rick's Nature Magazine.

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"Sidewalk Seasons." Ranger Rick's Nature Magazine, March 1974. Plants that may grow on sidewalk.

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Look Around You. Scholastic Earth Corps. Environmental Awareness Series, Book 1, 1972, $2.35.

*The True Book of Plants. Mener, Irene and Karl Murr. Chicago, Illinois: Children's Press, 1953. $3.00.

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Travelers All-The Story of How Plants Go Places. Zuebber, Iram E. - New York: Wm. Scott, Inc. $2.75.

*Seeds By Wind and Water. Jordan, Helene J. New York: Thomas Crowell, 1962. $3.50.

Seeds and Seed Travel. Parker, Bettha Morris. New York: Harper Row, 1959. $.56.

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How Seeds are Scattered. Sound Film Strips. $11.00

Plants and Their Environment. Sound Film Strips. $11.00.

Set of 4 Sound Film Strips $36.00 (#433-R) Lakeland, Fla.: Imperial Film Co.

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*The True Book of Trees. Podendorf, Illa. New York: Children's Press. 1954. $3.00.

Trees - The Art of Seeing Series. 10 min. Col. ACI Films Inc., 35 West 45th. Street., New York, N.Y. 10036. Free upon request.

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Trees: Earth's Largest Life Forms." Lakeland, Fla.: Imperial Film Co. $7.00 Filmstrip.

*A Tree is a Plant. Bulla, Clyde Robert. New York: Thomas J. Crowell Co. 1960. $3.50.

Trees Are a Crop. Ranger Rick's Nature Magazine, April 1970. p. 14.

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"The American Elm." Ranger Rick's Nature Magazine, April 1971, p. 34.

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Litter Prevention: A First Step To Improving The Environment. Keep America Beautiful, Inc. 99 Park Ave. New York, N.Y. 10016. 20¢ per copy.

STUDENT CARD #22

Teacher's Guide for Changes. Elementary Science Study, New York: McGraw-Hill, Webester Div. $2.98.

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"Happy Bee." Ranger Rick's Nature Magazine, July 1974. Article explaining Oregon's laws banning throw-aways.

STUDENT CARD #24

"Keeping Cool." Nature & Science. May 1968.

"Ranger Rick and His Friends, Adventure #79," Ranger Rick's Nature Magazine, Feb. 1975. Story about a polluted stream and its affect on wildlife.

"What's Happening at Your House?" Ranger Rick's Nature Magazine. (This article is contained in the Ranger Rick reprint on water pollution. Single reprints free upon request.)

STUDENT CARD #25

"Who's Behind that Trapdoor?" Ranger Rick's Nature Magazine, Jan. 1971, p. 28.

*Where Does The Butterfly Go When It Rains? Garelick, May. New York: Young Scott Books, 1961. Excellent book for primary on animals and their shelters. $2.98.

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*The True Book of Animal Homes. Podendorf, Illa. Chicago: Children's Press, 1960. $3.00.

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*Earthworms. Hogner, Dorothy Childs. New York: Thomas Crowell Co.

Unit Seven: Animals Live & Grow, Concepts in Science, Book 2, Teacher's Edition. Harcourt, Brace. Section on earthworms and setting up a worm farm.

Experiences With Living Things. Wensburg, Katherine. Boston: Beacon Press, 1972. $4.96. Teacher resource story about earthworms.

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*The True Book of Insects. Podendorf, Illa. Chicago: Children's Press, 1954. $3.00.

*Ladybug, Ladybug, Fly Away Home. Hawes, Judy. New York: Thomas Y. Crowell, 1967. Let's Read and Find Out Series. $3.50.

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"The Yucca Tree and the Moth." Ranger Rick's Nature Magazine, April 1971.

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*The True Book of Spiders. Podendorf, Illa. Chicago: Children's Press 1965. $3.00.

*Spiders. Hogner, Corothy Childs. New York: Crowell, 1955.

Spider Engineers. Film. Color 18 min. Moody Bible Institute. (Excellent film on spiders and their habits.) County: #8-488 Film.

*Spider Silk. Golding, Augusta. New York: Thomas Y. Crowell, 1964. Let's Read and Find Out Series. $3.50.

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"Fishin' for Dinner." Ranger Rick's Nature Magazine, Oct. 1973. Shows unusual ways spiders catch their prey.

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STUDENT CARD #29

*The True Book of Birds We Know. Friskey, Margaret. Chicago: Children's Press, 1954. $3.00.

Sandpipers. Hurd, Edith Thacher. New York: Thomas Y. Crowell, 1961. Let's Read and Find Out Series. $3.50.

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*Birds Eat and Eat and Eat. Gans, Roma. New York: Thomas Y. Crowell, 1964. Let's Read and Find Out Series. $3.50.

Birds. Zim, Herbert S., Ph.D. & Gabrielson Iran. New York: Western Publishing Co., 1949. $1.00. Bird identification.

Birds. New York: Golden Press. (Simple guide for identification of birds.) $1.25

STUDENT CARD #29 (cont.)

Birds. SVE-Chicago: Society for Visual Education #A461 $5.75. Filmstrip.
"The Here There and Everywhere Bird." Ranger Rick's Nature Magazine, Dec. 1974. Article on house sparrow, excellent pictures.
"Let's Make a Bird Cake." Ranger Rick's Nature Magazine, Jan. 1975. Directions for a different bird feeder.
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"Woodpeckers." Ranger Rick's Nature Magazine, Aug./Sept. 1974. Article showing adaptations of woodpeckers.

STUDENT CARD #30

Pets - #103 $8.00, Wild Animals - #105 $8.00, Society for Visual Education, Inc., 1345 Civersey Parkway, Chicago, Illinois. Study Prints.
"The Zoo - A Special Place." Ranger Rick's Nature Magazine.

STUDENT CARD #31

"What Do You Do When You Don't Have a Tub?" Ranger Rick's Nature Magazine.
Pets - #103 $8.00, Wild Animals - #105 $8.00, Society for Visual Education, Inc., 1345 Civersey Parkway, Chicago, Illinois. Study Prints.

STUDENT CARD #32

"Castles and Mirrors and Cities of Sand." Bright Horizons: A Collection. Scott Foresman Co., N.Y.
Experiences With Living Things. Wensburg, Katherine. Boston, Beacon Press, 1972. $4.75. Story about sand.

STUDENT CARD #33

The Story of Sea Turtles. McQuillan, J.R. Department of Natural Resources, State of Florida. Free upon request.
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"One Hundred Turtle Eggs." Nature and Science, Dec. 16, 1968.
"How Turtles Find the Sea." Nature and Science, Jan. 6, 1969.
"The Box Turtle." Ranger Rick's Nature Magazine, July 1969. p. 29.
"The Thing in the Swamp." Ranger Rick's Nature Magazine, March 1975. Article about a large snapping turtle.

STUDENT CARD #34

*Big Tracks, Little Tracks. Branley, Franklin M. New York: Thomas Y. Crowell, 1960. Let's Read and Find Out Series. $3.50.

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Florida Animal Tracks. Tallahassee: Florida Game and Fresh Water Fish Commission, 1968. Free upon request.

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Why Do Animals Hide? Santa Monica: BFA Media, Filmstrip, one of a set, $40.00.

Hidden Animals. Selsam, Millicent E. National Wildlife Federation. Single copy - free on request.

"A Good Day." More Fun With Our Friends. Chciago: Scott Foresman.

*Adaptations to Water Environment. Santa Monica: BFA Media. Set of study prints with suggestions for utilization. $8.00.

"Nature's Bag of Tricks." Ranger Rick's Nature Magazine, Dec. 1973, Dec. 1974. Adaptations, camouflage; well illustrated.

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"Skeletons Aren't Scary." Ranger Rick's Nature Magazine, Oct. 1971.

Teacher's Guide to Bones. Elementary Science Study New York: Webster Division of McGraw-Hill.

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"Mary and the Monster." Ranger Rick's Nature Magazine, March 1974 Story about efforts to unearth a fossil.

"A Mountain of Bugs." Ranger Rick's Nature Magazine, Aug./Sept. 1974. Article, illustrations on fossils.

Fossils. Sim and Gabrielson (A Golden Nature Book) $2.00

STUDENT CARD #38

*The True Book of Dinosaurs. Clark, Mary Lou. Chicago: Children's Press 1955. $3.00.

In The Time of the Dinosaur. Wise, William. New York: Scholastic Book Service.

"Where Dinosaurs Roamed." Ranger Rick's Nature Magazine, July 1975 Article and pictures from Utah's Dinosaur National Moument.

"Who Knows?" Ranger Rick's Nature Magazine, July 1975. Article theorizing on appearance of dinosaurs.

STUDENT CARD #39

What Do Animals Eat? Santa Monica: BFA Media. Set of five filmstrips. $40.00. (One deals with animal foods).

"Plants That Eat Insects." Ranger Rick's Nature Magazine, Nov. 1970, p. 42.

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"Food Chains." Ranger Rick's Nature Magazine, January 1972, p. 17.
Where We Get Our Food. Chicago: National Dairy Council, 1967. Free upon request.

STUDENT CARD #42

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STUDENT CARD #43

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STUDENT CARD #45

"Our Friends the Hawks." Bulletins on Animals. New York: National Audubon Society, 1969. $3.60 for 13 bulletins.
"Pesticides." Ranger Rick's Nature Magazine. National Wildlife. Single copies free upon request.

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"Birds of Prey." Ranger Rick's Nature Magazine, March 1974. Reasons for decline in these birds, efforts of scientists to save them.
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"Predators-We Need Them." Ranger Rick's Nature Magazine, Feb. 1969. By Fischer, Richard B.
"Timber Wolf." Ranger Rick's Nature Magazine, December 1974. Describes plight of timber wolf.

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"Eyes." Warner, Constance P. Ranger Rick's Nature Magazine, Feb. 1973.
"Man and Owl." Audubon Magazine. November 1971. Parnall and Cameron.
"Our Friends the Hawks." Bulletins on Animals. New York: National Audubon Society, 1969. Leaflet $3.60 per set.
"Owls Are Predators." Bulletins on Ecology. New York: National Audubon Society, 1970. Leaflet $2.60 per set.

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Fresh-water Encounter. Reprinted from Florida Naturalist, October 1973. Reprints free upon request from Dick Tillis, Bur. of Environmental Education, Tallahassee, Florida 32304.

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"Frogs Toads." Ranger Rick's Nature Magazine, May/June 1974.
Excellent article on frogs and toads, their life cycles, characteristics, defenses.
Teacher's Guide to Eggs and Tadpoles. Elementary Science Study. Webster Division of McGraw-Hill. $2.82.
"Toads and Frogs." Ranger Rick's Nature Magazine, May 1974.

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"Estuaries." Ranger Rick's Nature Magazine, November 1971.

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"Armored Pills." Ranger Rick's Nature Magazine, July 1974.
Illustration, descriptions of some vacant lot creatures.
Birds. New York: Golden Press. $1.25. Identification guide.
Flowers. New York: Golden Press. 1950. $1.15. Identification guide.
Insect Pests. New York: Golden Press. 1966. $1.25. Identification guide.
"Once There Was a Field." Ranger Rick's Nature Magazine, May/June 1974.
Looks at food chain and changes in a vacant lot.
Reptiles and Amphibians. New York: Golden Press. 1966. $1.25. Id. guide.
School Yard Encounter. Reprinted from the Florida Naturalist, February 1974.
Copies free upon request from Bur. of Environmental Education, Tallahassee, Florida 32304.
*The True Book of Weeds and Wild Flowers. Podendorf, Illa. Chicago: Children's Press, 1955. $3.00.
Urban Wildlife. David Lahart, Reprinted from Florida Wildlife. Reprints available free from Bur. of Environmental Education, Tallahassee, Fla. 32304.

STUDENT CARD #51

"Pesticides Are Perilous." Ranger Rick's Nature Magazine. Reprint, single copies free upon request.

STUDENT CARD #52

Ranger Rick's Nature Magazine. March 1972.
Article about chickaree squirrel.

STUDENT CARD #53

"The Cranes Are Dancing." Ranger Rick's Nature Magazine, July 1974.
Article, pictures on greater sandhill crane.
Ecology Cards: Colorado Springs, Colorado: Current, Inc. Set of 8 cards with parent and offspring on cover, information about animal on back. $1.00 per set.
Florida's Endangered Dozen. Lahart, David. Florida Dept. of Education.
Reprint free upon request from Bur. of Environmental Education.
From the Brink of Extinction. George, Jean. National Wildlife. April/May 1969.

STUDENT CARD #53 (cont.)

"The Plight of the Ocelot." *Ranger Rick's Nature Magazine,* May/June 1974. Reasons for decline in numbers of ocelots.

"Return of the Spoonbill." Bacon, Thorn. *Ranger Rick's Nature Magazine,* April 1972.

The Right To Exist. U.S. Government Printing Office-Washington, D.C. 20402 25¢.

"Where Have All the Ospreys Gone?" Hess, John. *National Wildlife.* Dec./Jan. 1971.

"Wildlife in Danger." Jocelyn, Arundel. *Ranger Rick's Nature Magazine,* February 1970.

INDEXES

SUBJECT INDEX

Adaptations

-as an aid to survival. 27,36,37,38
-coloring. 36,38
-diversity. 3,27
-for food-getting. 28,40
-of amphibians (frogs). 48
-of birds. 29
-of earthworms. 26
-of insects (cockroaches). 27
-of night-time hunters. 47
-of owls. 47
-of predators. 46,47
-of seeds. 18
-of spiders. 28
-to changing environment. 29,37,38,48

Amphibians

-adaptations of. 48
-life cycle of frog. 48

Animal Grooming

-booklet about. 31-1 through 31-12

Animals (see specific animal)

Ants

-as insects. 27
-interaction of. 14
-in a vacant lot. 50-4
-making an anthouse. 14-1

Awareness

-activities on. 1 through 16

Bats

-grooming of. 31-9

Beaches

-importance of. 32
-as a nesting place for sea turtles. 33

Bear

-grooming of. 31-7

Beauty

-appreciation of. 11

Bird Feeders

-making of. 29

Birds

-adaptations of. 29
-grooming of. 31-10
-identification of. 29
-of the city. . . . . 29-1 through 6

Centipede

-description of. 50-3

Chameleon

-adaptations of. 36,50-4
-as an example of protective coloration. 36
-role in a vacant lot. 50-4

Change

-adaptations to. 29,37,38,48
-as a characteristic of living things. 2,4,17
-due to pesticides. 51
-effect on living things. 37,38,53
-in beaches. 32
-in birds. 29
-in color. 36
-in decaying matter. 22
-in the environment. 4,29,37,38,53
-in an estuary. 49
-in frogs and tadpoles. 48
-in nonliving things. 2
-in soil. 26
-in a vacant lot. 50
-in water. 24
-in your life. 4

Chemicals

-for ant communication. 14-1
-pesticides. 51-8

Cinquain

-how to write. 12

Cockroaches

-as an example of a good survivor. 27-3

Coconuts

-story about. 18-1

Coloration

-for protection. 36

Communication

-among animals. 14-1

Compost

-directions for. 22

Consumers

-in a food chain. 42,44
-in a food pyramid. 45
-in a food web. 43
-in a vacant lot. 50

Cookies

-recipe for. 39-1

Coquina

-fossil shells of. 38

Crane, Sandhill

-as an endangered species. 53-17

Crocodile, American

-as an endangered species. 53-19

Cycles

-life cycles. 27,33,48

Darter, Okaloosa

-as an endangered species. 53-16

DDT
-in a food pyramid. 45
-as a pesticide. 51

Decay
-role in changing natural litter. 22
-role of decomposers. 42

Decomposers
-in a compost. 22
-in a food chain. 42
-in a food web. 43
-in a vacant lot. 50

Differences
-between insects and spiders. 27
-between living and nonliving things. 2
-in animal grooming techniques. 31
-in animal homes. 25, 26, 28
-in environments. 1, 16
-in footprints. 34, 35
-in living things. 3, 18, 19, 20
-in odors. 7
-in shapes. 5
-in sounds. 8
-in textures. 6
-in zoos. 30

Dinosaur
-as an example of an extinct animal. 38

Dog
-cooling of. 24
-grooming. 31-7

Eagle, Bald
-as an endangered species. 53-14

Earthworm
-environment of. 26
-importance of. 26
-grooming. 31-3
-role in a vacant lot. 50-3

Elephant

- -grooming. 31-4

Endangered Species

- -explanation of. 53
- -in Florida. 53
- -reasons for. 53-1 to 53-24
- -owls and hawks. 46

Energy

- -in a food chain. 41,42
- -in a food web. 43
- -wheel 42-1

Environment

- -awareness of. . . . . 1 through 16
- -changes in. 4,15,32,53
- -interaction in. 14,15,16,43
- -understanding of the word. 1

Estuaries

- -importance of. 49
- -understanding of. 49

Evaporation

- -of water. 24

Exoskeleton

- -animals with. 37,50-2

Feelings

- -about caged animals. 30
- -about happenings in the environment. 10
- -about nature. 12
- -about noise. 9

Fish

- -picturing the environment of. 1

Food Chain

- -explanation of. 41
- -in an estuary. 49

Food Chain (cont.)

-in vacant lot. 50
-links of. 41-1
-pesticides in. 51
-play about. 44-1
-roles in. 42,44,46,47

Footprints

-identification of. 34,35
-shape of. 34

Food Pyramid

-explanation of. 45
-roles in. 45

Food Web

-energy in. 43
-interaction in. 43
-interdependence in. 43

Fossils

-as evidence of past life. 37,38
-examples of. 37
-hunting for. 38-3

Frog, Pine Barrens Tree

-as an endangered species. 53-23

Frogs

-development of. 48

Garlic

-as a natural pesticide. 51

Gulls

-adaptations to city life. 29-4

Hawks

-as predators. 47

Hiding

-animals. 36
-toothpicks. 36

Homes, Animal
  -building one. 14, 26
  -observation of. 25

Horse
  -as an example of an animal that has changed. 37-1

Inchworm
  -song about. 11

Insects
  -characteristics of. 27
  -importance of. 27
  -life cycle of. 27-1
  -model of. 27
  -parts of. 27-1

Interaction
  -between your house and the environment. 15
  -examples of. 13, 14
  -in an ant hill. 14-7
  -in a food web. 43
  -in a small environment. 16
  -meaning of. 13

Interdependence
  -between living things . . . 13, 29, 41, 42, 43, 44, 45, 46, 47, 49, 50, 51, 52, 53
  -meaning of. 13
  -of beach and plants. 32
  -of earthworm and soil. 26

Jackrabbit
  -grooming of. 31-6

Kangaroo Rat
  -grooming of. 31-6

Kite, Everglades
  -as an endangered species. 53-12

Life Cycle

- of frogs. 48
- of insects. 27-1
- of sea turtles. 33

Litter

- classifying. 21
- collecting. 21
- understanding of. 21
- ways to reduce. 21

Living Things (see also specific animals and plants)

- in the environment. 2, 16
- interaction of (see interaction). 2, 4

Marigolds

- importance of. 11
- sponge painting of. 11

Map

- of a vacant lot. 50

Millipedes

- description of. 50-3

Moray eel

- grooming of. 31-11

Neighborhood

- observation of. 1-1

Night Hawks

- adaptations to a city environment. 29-6

Noise

- effects on people. 9
- feelings about. 9
- protection from. 9

Nonliving Things

- in the environment. 2, 16, 32
- awareness of. 2

Owls

-as predators. 47
-importance of. 47

Pelican, Brown

-as an endangered animal. 53-10
-as a final consumer. 45

Pesticides

-effects of. 51
-most dangerous ones. 51-8
-natural pesticides. 51-7

Pesticides, Garlic

-experiments with. 51

Pigeon

-adaptations to city environment. 29-2

Plants

-as producers. 41,42,44,45,49,50
-growth without seeds. 18
-as a living thing. 17
-characteristics of. 17
-parts of. 17-1

Play

-about food chains. 44-1

Predators

-bounties for. 46,47
-in food chains. 43,46,47,50
-role of. 46

Producers

-in a food chain. 42,44
-in food pyramid. 45
-in a food web. 43
-in a vacant lot. 50

Protective Coloration

-in animals. 36

Rabbit
- favorite foods of. 40

Recipe
- for animal foods. 40
- for cookies. 39-1

Recycling
- importance of. 23
- information card on. 23
- of water. 24

Reptiles
- in your area. 33,38

Rock Critters
- owls. 47

Sand
- identification of. 32
- uses of. 32

Seeds
- adaptations of. 18
- as food. 40
- awareness of. 18,40
- growth of. 40
- seed parts. 40
- ways they travel. 18

Shapes
- awareness of. 5

Skeletons
- as evidence of change. 37
- as fossils. 37
- relationship to animal. 37

Slugs
- description of. 50-1

Smell, Sense of
- -odor hunt. 7

Snails
- -explanation of. 50-1

Soil
- -living things in. 26,50

Sounds
- -interaction of. 8
- -producers of. 8,9

Sowbugs
- -description of. 50-2
- -home for. 50-2

Sparrow, House
- -adaptations to city environment. 29-3

Spiders
- -characteristics of. 28
- -diet. 28
- -importance of. 28
- -protection of eggs. 28
- -web spinning. 28

Squirrel
- -grooming. 31-1

Squirrel, Chickaree
- -territorial behavior. 53

Starlings
- -adaptation to city environment.. 29-1

Survival
- -aided by special adaptations. 18,36

Swifts, Chimney
- -adaptation to city environment. 29-5

Tadpoles
  -development of. 48

Territory
  -animal. 53
  -birds. 14-2, 53

Thumbprints
  -don't change. 4
  -pictures. 4

Tiger
  -grooming. 31-1

Touch
  -various textures. 6

Tracks
  -animal tracks. 35
  -identifying tracks. 35

Trees
  -details of. 19
  -grain. 20
  -leaf prints. 20

Water
  -cycle. 24
  -uses of. 24

SUBJECT AREA SKILLS INDEX

ART (Includes Basic Motor Activities)

1. Collages and Posters:

a. Collages

-favorite foods. 40
-foods we get from trees. 20
-how environmental changes affect you. 4
-interaction with the environment. 14
-living and nonliving things. 2
-natural objects. 6
-seeds you eat. 39
-sounds that bother people. 8
-things that affect the environment. 15
-things that you consider your territory. 53
-things that you like in the environment. 1
-uses of water. 24

b. Posters

-food chain. 41, 51
-food web. 43
-reasons we need trees. 20
-things from an estuary. 49

2. Coloring Activities

-animals grooming. 31
-birds. 29
-dinosaur. 38
-energy wheel. 42
-estuaries. 49
-tree. 19
-water cycle. 24

3. Cut and Paste Activities

-energy wheel. 42
-food chain. 41
-footprint. 34
-green plant. 17
-model of yourself. 3
-parts of a house. 15
-shapes. 5
-tree. 19
-water cycle. 24

ART (cont'd)

4. Drawings and Paintings

a. Drawings

- -adaptations for food-getting. 40
- -animal from its skeleton. 37
- -animal homes. 25
- -animals grooming. 31
- -cartoon of animals dreaming about food. 40
- -cartoon to show how noise affects people. 9
- -earthworm. 26
- -favorite bird. 29
- -fish in its environment. 1
- -hoop-world. 16
- -house. 15
- -life cycles. 27,33,48
- -life-sized model of yourself. 3
- -mural of life in a vacant lot. 50
- -pesticides in a food chain. 51
- -shape of a tree. 19
- -something you interact with. 13
- -something you smelled. 7
- -sound producer. 8
- -thumbprint pictures. 4

b. Paintings

- -about nature. 12
- -sand painting. 32
- -sponge painting. 11

5. Mobiles

- -from shapes. 5
- -of a food chain. 41
- -of your head. 3

6. Mosiacs

- -seed. 39

7. Picture Collections

- -predators. 46
- -smell words. 7
- -spiders and their prey. 28
- -sound producers. 8

ART (cont'd)

8. Prints and Rubbings

a. Prints

-fossil prints. 37
-leaf prints. 19
-spider web prints. 28
-thumbprints. 13
-weed prints. 12

b. Rubbings

-different textures. 6
-nonliving things. 2
-tree bark. 19

CRAFTS

-anthouse. 14
-bird feeder. 29
-decoupage of endangered animals. 53
-litter bags. 21
-model of an animal home. 25
-plaster casts of animal tracks. 35
-props for play about food chains. 44
-reusing items. 23
-scrapbook of tracks. 35
-stone critters. 47
-using shapes. 5
-wood craft. 20

DRAMA

1. Acting out

-grooming of an animal. 31
-thirsty and hungry animals. 10
-web making. 28

2. Plays and Puppet Shows

-play about food chain. 44
-puppet show about food chain. 41

LANGUAGE ARTS

1. Readings

a. Poetry

-cinquain. 12
-Inchworm. 11
-My Tree. 19

b. Related Readings

-animal homes. 25
-fossil hunting. 37
-George Washington Carver. 39
-helpful insects. 27
-owls. 47

c. Stories

-"Beaver, The" 25-2
-"City Birds" 29-1
-"Case of the Disappearing Turtle, The" 33-1
-"Different Language, A" 14-1
-"Do I Have To Take A Bath?" 31-1
-"Florida's Endangered Dozen" 53-1
-"Good Survivor, A" 27-1
-"House That Jack Built, The" 51-1
-"Links of Life" 41-1
-"Making of a Horse, The" 37-1
-"Mighty Seed, A" 18-1
-"Owl's Story, The" 47-1
-"Recycling" 23-1
-"Territorial Animal, A" 52-1
-"Wolves are Necessary" 46-1
-"Zoo-A Special Place, The" 30-1
-"Zoo Doctor" 30-3

2. Writings

a. Letters

-about predators. 46
-pretending you are a turtle. 33
-telling why estuaries are important. 49

b. Paragraphs and Reports

-paragraph about pesticides. 51
-report about your favorite bird. 29

LANGUAGE ARTS (cont'd)

c. Poems

- -poem expressing your feelings about noise 9
- -poem or story about your environment 1
- -poem or story about your tree 19
- -poem using cinquain pattern 12

d. Stories

- -about a caged animal 30
- -about decomposers 42
- -about food pyramid 45
- -about life of an earthworm 26
- -about spiders 28
- -telling why we need green plants 17
- -using fossils 37
- -where tracks are important 34

3. Vocabulary

- -grooming words 31
- -litter words 21
- -smell words 7
- -texture words 6

MATH

- -computing size of a dinosaur 38
- -measuring 20, 21, 22, 24, 38, 39, 40
- -using scale drawings 38

MUSIC

- -listen to song "Inchworm" 11
- -song about senses 12

PROCESS SKILLS

1. Observing

- -animal grooming 31
- -animal homes 25
- -ants 14
- -birds 29, 52
- -change 4
- -compost pile 22
- -differences in temperatures 22, 20
- -earthworm 26

PROCESS SKILLS (cont'd)

-fossils 37
-frog's life cycle 48
-green plants 17
-growth of seeds 39
-interaction 14,16
-life in an estuary 49
-life in a vacant lot 50
-litter 21
-local animals 40
-nonliving things 2
-of beauty 11
-of shapes in the environment 5
-personal characteristics 3,4
-producers, consumers, decomposers 42
-protective coloration 36
-sand 32
-sounds 8
-spiders 28
-things in the environment 1
-tree 19
-turtles 33

2. Classifying

-characteristics that change 4
-footprints 34
-insects 27
-interaction and interdependence 13,14
-litter 21
-living and nonliving things 2,3,16
-producers, consumers, decomposers 42,50
-seeds 18,39
-shapes 5
-sounds 8
-textures 6
-things that will decay 22
-tracks 35

3. Collecting, Recording and Analyzing Data

-analyzing data 16,30,35
-collecting and recording data 3,16,21,22,23,25,26,29,30,35,48,51
-recording temperatures 20,22

PROCESS SKILLS (cont'd)

4. Hypothesizing

    -about the disappearance of dinosaurs 38

5. Measuring

    -in cooking 39,40
    -litter collected 21
    -size of a dinosaur 38
    -temperature 20,22
    -water usage 24

6. Predicting

    16,19,22,41,42,43,45,46,48

SCIENCE ACTIVITIES

1. Carrying out Experiments

    -composting 22
    -determining the age of a tree 19
    -growing a plant without a seed 18
    -on stimulation 30
    -sampling 16
    -surveying to fill in data card 16, 21
    -with earthworm 26
    -with evaporation 24

2. Mapping

    -school yard 21
    -vacant lot 50

3. Plan an Experiment

    -to reduce litter 21
    -to reduce noise 9
    -to see if nonliving things change 2
    -with natural pesticides 51

INDEX OF INFORMATION CARDS

BLACK AND WHITE MASTERS:

-animal skeleton 37-5
-diagram of an estuary 49-3
-energy wheel 42-1
-green plant and parts 17-1
-hidden animals 36-1
-house parts 15-1
-life cycle of a bullfrog 48-1
-life cycle of insect 27-1
-litter maze 21-1
-parts of insect 27-1
-parts of a tree 19-1
-recycling paper saves trees 23-7
-scale drawing of dinosaurs 38-1
-seed travelers 18-1
-things that need trees 19-1
-water cycle wheel to construct 24-1
-where does your glass of milk come from? (food chain) . . . 41-3

DATA CARDS:

-data card, That Make Me Special 3-1
-How Good is Your Zoo? 30-2
-living and nonliving things in a small environment 16-1
-observations of litter in our environment 21-2

EVALUATION CARD:

-animal homes 25-2
-food chain parts 41-4
-food web parts 43-1
-identifying things in your environment 1-1
-insect identification 27-2
-things that change, do not change 4-1
-which print is yours? (footprints) 34-1

STORIES:

-"Beaver, The" . . . 25-2
-"Case of the Disappearing Turtles, The" . . . 33-1
-"City Birds" . . . 29-1
-"Different Language, A" . . . 14-1
-"Do I Have To Take A Bath?" . . . 31-1
-"Making of A Horse, The" . . . 37-1
-"Mighty Seed, A" . . . 18-3
-"Owl's Story, The" . . . 47-1
-"Territorial Animal, A" . . . 52-1
-"Wolves Are Necessary" . . . 46-1
-"Zoo Doctor" . . . 30-4

STUDENT INFORMATION CARDS:

-Cide List, The . . . 51-5
-estuaries . . . 49-1
-Florida's Endangered Dozen . . . 53-1
-Fossil Huntin . . . 38-3
-Good Survivor, A . . . 27-3
-House That Jack Built, The . . . 51-1
-Interaction in an Anthill . . . 14-4
-Life in a Vacant Lot . . . 50-1
-Links of Life . . . 41-1
-Pesticides are Poison . . . 51-7
-play about food chains . . . 44-1
-recipe for Fine Cookies . . . 39-1
-recycling . . . 23-1
-stone critters . . . 47-5
-Zoo-A Special Place, The . . . 30-1